SUMMER '66 ÉTÉ

CANADA AGRICULTURE

MINISTER, HON. J. J. GREENE, MINISTRE ■ DEPUTY MINISTER, S. C. BARRY, SOUS-MINISTRE

JOURNAL OF THE CANADA DEPARTMENT OF AGRICULTURE
JOURNAL DU MINISTÈRE DE L'AGRICULTURE DU CANADA

"Canada Agriculture" is published quarterly by the Canada Department of Agriculture. Its purpose is to help keep extension workers and agri-businessmen informed of developments in research and other federal agricultural responsibilities as carried on by the various units of the Department.

Contributors, namely, professional personnel in the Department's Research, Economics, Health of Animals, and Production-Marketing Branches, Special Act Administrations (PFRA, etc.), and the Farm Credit Corporation are invited to submit their articles in either English or French.

Contributions should be addressed to the Secretary, Editorial Board, Information Division, Canada Department of Agriculture, Ottawa.

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«Canada Agriculture», publié par le ministère de l'Agriculture du Canada, paraît tous les trois mois. Ce journal a pour objectif de renseigner sur l'activité des Directions du ministère, les agronomes et les hommes d'affaires intéressés à l'agriculture.

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VOL. 11 SUMMER 1966 NO. 3
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DAIRY POLICY BOOSTS RETURNS

For the first time in five years, Canada has no dairy product surplus. Demand has caught up with supply. Total milk supply has not increased by any significant amount since 1961. For example, total milk production in 1961 reached 18.3 billion pounds. In 1965 production had not changed at 18.3 billion pounds. Production has not kept pace with increased demand spurred on by population growth, reduced butter prices to the consumer and disposal of surplus production in the export market.

Demand was so great in 1965 that domestic consumption of butter alone exceeded production by some 20 million pounds. Demand has also reduced dairy warehouse stocks so that Canada entered 1966 without any burdensome surplus of any dairy product according to officials of the Canada Department of Agriculture.

The problem then was clear: should this trend continue where production did not keep pace with increasing demand, shortages of dairy products could result and consumer prices could spiral upward.

This is why the Hon. J. J. Greene, Minister of Agriculture, recently expanded his dairy program with a new dairy policy. This policy came into effect on April 1, 1966, the start of the dairy year, which runs to March 31, 1967. The following are the key objectives:

—Raise dairy producers incomes

—Bring economic stability to the dairy industry

—Prevent any sharp consumer price increases

The new dairy policy is designed to relieve the prospect of shortages. The measure should also help to encourage farmers to stay in dairy farming which can now be more profitable, and to lessen the switch

LA POLITIQUE LAITIÈRE AUGMENTERA LES REVENUS

Pour la première fois depuis cinq ans, le Canada ne compte pas d'exédents de produits laitiers. En 1965, tout comme en 1961, la production globale de lait s'élevait à 18.3 milliards de livres. La production ne s'est pas maintenue au rythme de l'accroissement de la demande sous l'impulsion de la poussée démographique, de la baisse des prix du beurre à la consommation et de l'écoulement des excédents sur le marché d'exportation.

En 1965, la consommation intérieure de beurre a dépassé la production de quelque 20 millions de livres. La demande a réduit les stocks de produits laitiers en entrepôt et le Canada a commencé l'année 1966 sans excédents encombrants de produits laitiers, nous apprend le ministère de l'Agriculture du Canada.

Un problème se posait alors; si l'on ne parvenait pas à enrayer cette tendance d'une production inférieure à la demande, il pourrait en résulter une pénurie de produits laitiers et une montée des prix à la consommation.

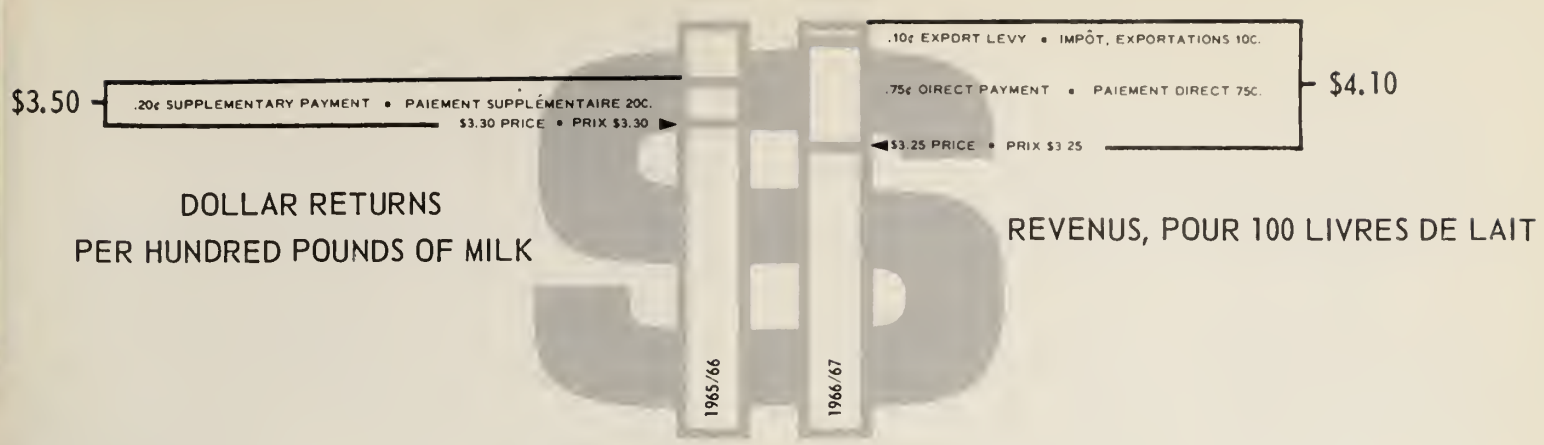
C'est la raison pour laquelle l'honorable J. J. Greene, ministre de l'Agriculture a récemment établi une nouvelle politique laitière. Cette politique est entrée en vigueur le 1er avril 1966, ouverture de la campagne laitière qui se termine le 31 mars 1967.
En voici les buts principaux:

—Accroître les revenus des producteurs de lait;

—favoriser la stabilité économique de l'industrie laitière;

—éviter toute hausse marquée des prix à la consommation.

La nouvelle politique laitière devrait encourager les cultivateurs à rester dans l'industrie laitière, et les



DOLLAR RETURNS
PER HUNDRED POUNDS OF MILK

REVENUS, POUR 100 LIVRES DE LAIT

to other kinds of farming, such as raising beef, hogs, poultry and grain production.

The new policy directly affects thousands of dairy producers. Fluid milk producers, manufacturing milk producers, and cream producers stand to gain. There are about 35,000 fluid milk producers. These dairymen supply the fresh milk trade. There are about 70,000 manufacturing milk producers who supply the processors who manufacture casein, milk powder, butter and cheese. And there are about 165,000 cream shippers whose product is made into butter only.

Mr. Greene pointed out in the House of Commons that during last year (dairy year ended March 31, 1966), government policy was to ensure producers, through a combination of supplementary and deficiency payments and offer-to-purchase program for butter and cheese, combined with a subsidy on butterfat used in butter, a national average return of $3.50 per hundred pounds of manufacturing milk. This represented a significant improvement in the producers' position over previous years, when prices averaged less than $3.00 per hundredweight.

HOW DAIRY POLICY WORKS IN 1966-67

The Agricultural Stabilization Board is administering the new policy to the various categories of producers generally this way:

• For producers of manufacturing milk, the Board has taken measures to permit processors to pay producers around $3.25 per hundredweight. This $3.25 price is based on 3.5 per cent fat for top quality milk delivered to the factory. Direct payments are being made by the Board to producers at the rate of 85 cents per hundredweight of milk, minus a 10 cent export levy which is placed in a fund to help any possible export of surplus.

On this basis producers receive 75 cents direct payment on top of about $3.25 support price which brings them an average net return of approximately $4.00 per hundredweight for their 3.5 per cent milk. Should their milk test higher they get paid more. For example, 4 per cent milk would bring the direct payment up to about 86 cents for every hundredweight. This works out at four times 21.43 cents paid per pound of butterfat.

dissuader d'entreprendre d'autres types d'exploitations, telles l'élevage des bovins de boucherie ou des porcs, l'aviculture ou la culture des céréales.

Cette politique touche des milliers de producteurs: quelque 35,000 alimentent le commerce du lait nature; environ 70,000 livrent leur lait aux fabricants de caséine, de lait en poudre, de beurre et de fromage; quelque 165,000 expédient la crème laquelle est transformée en beurre seulement.

M. Greene a souligné, à la Chambre, que durant la dernière campagne laitière terminée le 31 mars 1966, la politique du gouvernement visait à assurer aux producteurs une moyenne nationale de $3.50 les cent livres de lait de transformation au moyen d'une combinaison de paiements supplémentaires et d'appoint, un programme d'offre d'achat de beurre et de fromage, ainsi qu'une subvention sur la matière grasse utilisée dans la fabrication du beurre. On se rappelle qu'au cours des années précédentes, le prix moyen du lait industriel n'atteignait pas $3 les cent livres.

POLITIQUE LAITIÈRE DE 1966-1967

L'Office de stabilisation des prix agricoles applique la nouvelle politique de la façon suivante:

• Pour les producteurs de lait de transformation, l'Office a pris des mesures qui permettent aux conditionneurs de payer aux producteurs environ $3.25 les cent livres. Ce prix de $3.25 est basé sur une teneur de 3.5 p. 100 de matière grasse pour le lait de première qualité livré à l'usine. L'Office verse des paiements directs aux producteurs à raison de 85 cents les cent livres de lait, moins un droit de 10¢ à l'exportation d'excédents possibles.

De cette façon, les producteurs reçoivent un paiement direct de 75 cents en plus du prix de soutien d'environ $3.25, ce qui porte le prix net moyen à environ $4 les cent livres de lait contenant 3.5 p. 100 de matière grasse. Si la teneur en gras est plus élevée, les producteurs recevront davantage; par exemple, une teneur de 4 p. 100 porterait le paiement direct à

The reader will observe from the diagram that this $4.00 return in 1966-67 contrasts to the $3.50 per hundredweight milk received in the previous 1965-66 dairy year. In specific terms this means 50 cents more is paid this year compared to last year.

• Cream shippers will receive direct payments of 21.34 cents per pound of butterfat, which is equivalent to the 75-cents-per-hundredweight payment being made to whole milk shippers on 3.5 per cent milk.

Authority has also been provided to permit the Board to make an appropriate adjustment in the direct payment to producers should the Board's selling price of butter be increased above the purchase price of 59 cents per pound during the support year.

• Fluid milk producers are getting the benefit of an innovation in the new policy. They can participate this year since an extension has been made to include a portion of surplus fluid milk under subsidy. The payment to fluid milk producers will be at the same rate as the manufacturing milk producers, that is 85 cents per hundredweight, minus the 10 cent export levy.

The payment will apply to milk delivered in excess of 120 per cent of the producer's deliveries for which he receives fluid milk prices. Take, for example, a fluid milk shipper who delivers during the month a total of 20,000 pounds. He is paid at fluid milk prices for 14,000 pounds and at lower prices for the rest; 120 per cent of 14,000 pounds is 16,800 pounds. The amount this producer delivers eligible for the direct federal payment would therefore be 20,000 pounds minus 16,800 pounds. The federal payment would be made for 3,200 pounds.

FORMULA FOR CALCULATING SUBSIDY ON FLUID MILK:

20,000 pounds delivered to factory
14,000 pounds gets fluid milk price
Then 120 per cent of 14,000 pounds = 16,800 pounds
So 20,000 pounds—16,800 pounds = 3,200 pounds
Subsidy payment is made on this 3,200 pounds

This new policy represents a massive administrative undertaking, and to be successful will require the co-operation of everyone involved, whether they be producers or processors—all of whom stand to benefit from its successful implementation. •

environ 86 cents les cent livres. Le diagramme permet de constater que ce prix de $4 en 1966-1967 se détache nettement des $3.50 les cent livres de lait obtenus au cours de la campagne laitière de 1965-1966. Il s'agit précisément, d'une hausse de 50 cents en regard de l'an dernier.

• Les expéditeurs de crème recevront un paiement direct de 21.34 cents la livre de matière grasse, soit l'équivalent du paiement de 75 cents les cent livres de lait versé aux expéditeurs de lait entier à 3.5 p. 100 de matière grasse. L'Office est autorisé à effectuer un ajustement approprié du paiement direct versé aux producteurs si le prix de vente du beurre de l'Office est augmenté au-dessus du prix d'achat de 59 cents la livre au cours de l'année de soutien.

• Les producteurs de lait nature bénéficient d'une innovation dans la nouvelle politique. En effet, ils ont droit à la subvention sur une partie de l'excédent de lait nature. Le paiement versé aux producteurs de lait nature ainsi qu'aux producteurs de lait de transformation, sera au même taux: soit 85 cents les cent livres, moins les 10 cents de droit à l'exportation.

Le paiement s'appliquera au lait livré en excédent de 120 p. 100 des livraisons pour lesquelles le producteur reçoit le prix du lait nature. Prenons par exemple le cas d'un producteur qui expédie 20,000 livres durant le mois. Il obtient le prix du lait nature sur 14,000 livres et un prix plus bas sur le reste; 120 p. 100 de 14,000 livres équivaut à 16,800 livres. La quantité sur laquelle ce producteur a droit au paiement direct du fédéral sera de 20,000 livres moins 16,800, soit 3,200 livres.

FORMULE POUR CALCULER LA SUBVENTION SUR LE LAIT NATURE:

20,000 livres livrées à la laiterie
14,000 livres au prix du lait nature
120 p. 100 de 14,000 livres = 16,800 livres
20,000 livres—16,800 = 3,200 livres

Le paiement de la subvention s'appliquera donc à ces 3,200 livres. Pour mener le nouveau programme à bonne fin, il faut la collaboration des producteurs et des conditionneurs tous appelés d'ailleurs à bénéficier de sa mise à exécution. •

REACTION TO DAIRY POLICY

Has generally been favorable. An early trend has emerged. More producers are converting from cream to whole milk shipping. This is one factor that is pushing up whole milk supplies for manufacturing purposes, and is reducing cream marketings.

RÉACTION À LA POLITIQUE LAITIÈRE

En général, favorable. Plus de producteurs déjà tendent à abandonner l'expédition de la crème en faveur du lait entier. Il en résulte une augmentation des approvisionnements de lait de transformation et une diminution de la quantité de crème sur le marché.

LATEST DEVELOPMENTS

Myxin is now being produced in the Rosearch Branch laboratories, Canada Department of Agriculture. Dr. E. Peterson and Dr. D. Gillespie, two of the three members of the original research team that discovered myxin, are supervising production of the antibiotic in large enough quantities to allow larger scale testing bofore myxin is finally licensed for commercial production. The testing is being done in collaboration with the Biologics Control Laboratory, Departmont of National Health and Welfare under Dr. Louis Greenberg. He will carry out a program to establish a standard unit of potency for myxin by determining its toxicity in small laboratory animals, and by comparing myxin with proven control antibiotics.

LE MYXIN

A l'heure actuelle, le myxin est préparé dans los laboratoires de la Direction de la recherche du ministère de l'Agriculture du Canada. MM. E. Petorson et D. Gillespie, deux des trois membres de l'équipe qui a découvert le myxin, surveillent la production. L'antibiotique doit être produit en quantités suffisantes pour permettre d'intensifier les épreuves préalables à l'autorisation de la fabrication à l'échelle commerciale. Les épreuves seront effectuées en collaboration avec les Laboratoires de contrôle des produits biologiques du ministère de la Santé nationale et du Bien-être social, sous la direction de M. Louis Greenberg. Celui-ci cherchera à établir une unité étalon de puissance du myxin, en déterminant sa toxicité pour les petits animaux de laboratoire, et le comparant à des antibiotiques connus.

MYXIN

ANTIBIOTIC FIGHTS DISEASE IN PLANTS, ANIMALS AND MAN

Myxin, the wonder antibiotic, promises to fight disease in plants animals and man.

The discovery of Myxin, announced early this summer, was made by three Canadians. A young research team of Dr. F. D. Cook, 45, Dr. D. C. Gillespie, 39, and Dr. E. A. Peterson, 45, spent two years developing myxin at the Microbiology Research Institute, a unit of C.D.A.'s Research Branch in Ottawa.

At this early stage of development the potential of myxin amazes scientists.

Agriculture may reap great benefits. Myxin holds more promise today for disease control in plants and animals than any other antibiotic available. In laboratory tests it attacks a wide range of disease-causing organisms. It prevents growth of at least 34 species of bacteria, 49 species of fungi, 12 species of actinomycetes and 12 species of-yeast. Its potency is phenomenal. Concentration of only a few parts per million was successful in these tests.

Wide use is expected in the control of agricultural crop diseases. In lab tests it has been effective against many species of plant pathogenic bacteria which cause

ANTIBIOTIQUE CONTRE LES MALADIES DES VÉGÉTAUX, DES ANIMAUX ET DES HUMAINS

Avez-vous entendu parler du nouvel antibiotique myxin. Non. . . Alors vous ne savez pas qu'en annonçant sa découverte récemment on a dit qu'il pourrait devenir un moyen de défense important contre les maladies des végétaux, des animaux et des humains. Vous ne savez pas non plus qu'il est le fruit de deux années de travail de l'équipe des jeunes scientifiques MM. F. D. Cook, D. C. Gillespie et E. A. Peterson de l'Institut de recherches microbiologiques du ministère de l'Agriculture du Canada.

Les épreuves ne sont pas encore terminées mais déjà les possibilités du myxin ne cessent d'émerveiller les chercheurs.

Des antibiotiques reconnus, le nouveau-né est le plus prometteur. Il agit même à des concentrations de quelques parties par million.

Aux épreuves en laboratoire il s'est montré efficace contre au moins 34 espèces de bactéries, 49 espèces de champignons, 12 espèces d'actinomycètes et de 12 espèces de levures. Il a réagi contre les bactéries de la flétrissure bactérienne de la pomme de terre, la flétris-

such diseases as ring rot of potatoes, alfalfa wilt, fire blight of fruit trees, halo blight of oats and fungi that cause cereal root rot. Use of antibiotics in agriculture in the past has been limited by the high cost of production.

For those concerned with the fight against human disease much more research must be done, but test tube results already show that myxin is effective against the organism responsible for tuberculosis. It has also destroyed a penicillin-resistant strain of staphylococcus, of perennial concern to hospitals. As a first step in determining myxin's ultimate effect on humans, toxicity tests have shown that it does not harm small laboratory animals in the doses used.

The organism which produces myxin is a member of a group of soil bacteria known as myxobacters. While doing basic research on the relationship between soil bacteria, soil fertility and the health of plants, Ottawa-born Dr. Cook found that some myxobacters produced lytic enzymes which prevented growth of disease causing organisms in crops. At a later stage of research he saw that one myxobacter strain produced no lytic enzymes but, rather, a red material. This red material prevented growth of bacteria.

Dr. Gillespie, a native of Port Arthur, Ontario, successfully extracted this red material from broth in which the myxobacters had grown. He developed methods to produce, isolate, purify and crystallize the material to obtain myxin in its pure form. How was all this done? Special techniques were used to isolate the myxobacters from the soil. Then production of the myxin was carried out in a yeast-soil medium with added glycerol to promote antibiotic production. After only 20 to 24 hours the solution became pink, indicating the presence of myxin. Many other antibiotics require four to five days to be produced.

The antibiotic was then extracted from the solution with an organic solvent such as ether. Concentration under vacuum was needed to remove the liquid. This left a solid material consisting of myxin and some

sure de la luzerne, la brûlure bactérienne des arbres fruitiers, la tache auréolée de l'avoine et les champignons cryptogamiques qui causent la pourriture de la racine des céréales.

Facile à produire, le nouvel antibiotique sera aussi probablement utilisé dans la lutte contre des maladies des plantes dont le traitement au moyen d'antibiotiques n'a pas été économique jusqu'ici. L'agriculture en somme serait l'un des grands bénéficiaires de la découverte.

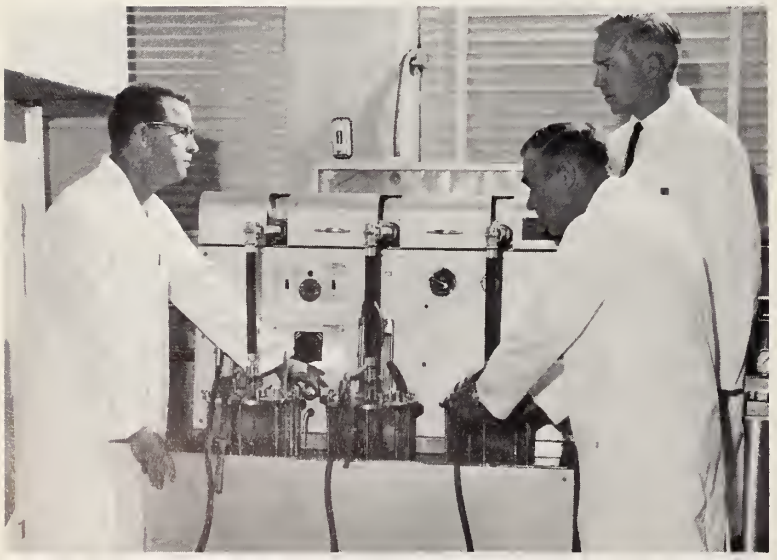
Le myxin n'est pas encore prêt à être employé dans la lutte contre les maladies des humains. Néanmoins, aux essais en éprouvette, il s'est montré efficace contre l'organisme responsable de la tuberculose et contre une lignée de staphylocoques résistante à la pénicilline, cause de difficultés dans les hôpitaux. Aux taux appliqués au cours des épreuves de toxicité, le myxin ne nuit pas aux petits animaux de laboratoire.

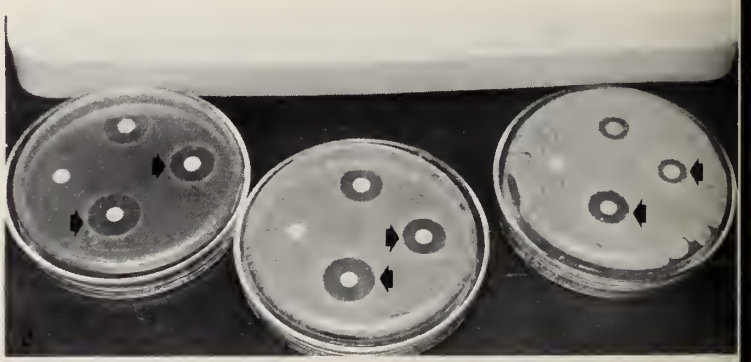
L'organisme qui produit le myxin appartient à un groupe de bactéries du sol connues sous le nom de myxobacters. Au cours de ses études sur les rapports entre les bactéries du sol, la fertilité du sol et la santé des végétaux, M. Cook a découvert que certains myxobacters produisent des enzymes qui détruisent les organismes pathogènes dans les cultures. Plus tard, il a découvert qu'une certaine lignée de myxobacters ne produisait pas d'enzymes lytiques mais plutôt une substance rouge, qui arrête la croissance des bactéries.

M. Gillespie a extrait la substance rouge d'une culture de myxobacters et mis au point des techniques pour obtenir le myxin à l'état pur.

On a d'abord isolé les myxobacters du sol; ensuite, on a cultivé le myxin en milieu levure-sol additionnée de glycérol pour accélerer la croissance. La culture a tourné au rose (indice de la présence du myxin) dès les 20 à 24 heures; par contre, grand nombre d'autres antibiotiques ne peuvent être produits que dans 4 ou 5 jours.

L'antibiotique est alors extrait à l'aide d'un solvant organique tel l'éther, puis le liquide évacué sous vide.





impurities. Final purification and separation of the antibiotic was done by means of a modern laboratory method known as chromotography. To conclude the process, further concentration yielded crystals of pure antibiotic.

Further studies by Dr. Peterson, a Saskatchewan Westerner, showed that myxin may be useful in combating plant diseases through seed treatment or by spraying on plant foliage. Germination tests were successful. Seeds soaked in myxin solution for as long as 24 hours proved that there had been no toxic effects on a large number of agricultural seed varieties tested. After spraying the foliage of different crops with myxin, no visible signs of harm to the plants could be detected. The fact that no toxicity was present may signal a major breakthrough in the control of agricultural crop diseases. When production reaches large scale proportions in the near future, it will then be possible to evaluate myxin's effectiveness against a wide range of important crop diseases in the field.

The Government has stated that myxin has been developed to a stage where it should be made available for possible commercial development by private pharmaceutical firms. Strong interest is being displayed by a large number of companies wishing to obtain licences to develop and produce this new product commercially.

Wide patent coverage has been obtained by Canadian Patents and Development Limited, the agency of the federal government concerned with patenting inventions by federal government employees.

Dr. R. M. Hochster, Director of the Microbiology Research Institute, has said that exhaustive testing must be done before the real value of the antibiotic can be established. It is structurally different from all existing antibiotics. A new field of antibiotic research has been opened by this development and a new generation of antibiotics is uncovered. •

Le myxin est ensuite purifié au moyen de la séparation par chromatographie, et concentré pour donner l'antibiotique crystallin tel qu'on le connaît à l'heure actuelle.

Des études par M. Peterson ont démontré que le myxin peut être appliqué sur de la semence ou sur le feuillage. Aux épreuves de germination, la semence trempée jusqu'à 24 heures dans une solution de myxin, ne portait pas d'indice d'effets toxiques sur un grand nombre de semences éprouvées. La pulvérisation sur le feuillage ne semblait pas non plus avoir d'effets nuisibles sur les plantes. Très bientôt, quand le myxin sera produit en plus grande quantité, on pourra évaluer l'importance de son rôle dans la répression d'une grande variété de maladies des cultures au champ.

Le gouvernement a annoncé que le myxin serait prêt à être exploité par des maisons pharmaceutiques. En effet, grand nombre de sociétés s'intéressent déjà à obtenir des permis.

Les droits d'auteur ont été assurés par le Bureau des brevets et droits d'auteur, un organisme du gouvernement fédéral qui se charge de faire breveter les inventions des fonctionnaires.

M. R. M. Hochster, directeur de l'Institut des recherches microbiologiques a dit qu'il faudra continuer les recherches avant que la valeur réelle du nouvel antibiotique puisse être établie. C'est que le myxin est d'une nature tout à fait différente des antibiotiques connus—sa découverte ouvre sans doute les portes vers des champs de recherches inconnus jusqu'ici; une nouvelle famille d'antibiotiques est probablement née. •

1—En 12 heures, l'appareil à fermentation produit 36 litres de culture contenant du myxin. N. Brown, J. Butterworth, techniciens et Dr E. Peterson, vérifient les commandes de l'appareil.

2—Les résultats des épreuves préliminaires démontrent l'action du myxin contre des organismes pathogènes. De gauche à droite: 1. bactéries entériques 2. *Klebsiella pneumoniae* 3. *Staphylococcus aureus*. Les zones claires marquées d'une flèche indiquent l'action du myxin. Dans chaque cas, le myxin est comparé avec un antibiotique témoin.

3—Démonstration de la technique d'injection des lapins pour l'épreuve de toxicité.

1—Fermentors producing 36 litres of crude culture fluid containing myxin (in 12 hours). N. Brown, technician; J. Butterworth, technician; and Dr. E. Peterson, check controls on the machine.

2—Early test results show action of myxin against pathogenic organisms. From L to R: 1. Intestinal bacteria 2. Klebsiella pneumoniae 3. Staphylococcus aureus. Clear zones on plate indicate myxin's potency (arrows). On each plate myxin is compared with a proven control antibiotic.

3—This shows how myxin will be injected into rabbits for toxicity testing.

ZIGZAG CLOVER


1


2


3

FORAGE CROP OF THE FUTURE?

R. W. ROBERTSON

Zigzag clover may prove to be a valuable perennial hay and pasture legume where red clover has been losing favor among farmers. When we do further testing on its seeding ability, zigzag could find wide use in the reseeding of sub-marginal pasture lands in all parts of Canada, especially the eastern areas.

The plant is like red clover, but the heads are a darker reddish purple and less dense. The solid stems are smaller and have a peculiar zigzag bend, hence its name, zigzag. There are two different types. One has a short round leaf with a distinct white mark and a compressed head. The other has a long narrow unmarked leaf and a long head. The narrow leaf appears to be of northern origin, because it goes into fall dormancy earlier and starts growth later in the spring.

There is a great variation in habit of growth in zigzag. Some are upright and attain a height of 24 inches, while others are quite prostrate and may spread to as much as 32 inches.

Zigzag grows in a few scattered locations in Eastern Canada, namely the Matapedia and Gatineau Valleys, Quebec; Glengarry County, Ontario and in the St, John Valley, New Brunswick. The plant which is native to North Central Europe and the Volga Region of Eastern Russia, was brought to North America by the early settlers in mixtures with red clover.

Once established, zigzag has been known to live 50-75 years while red clover usually dies after its second year. One reason for zigzag's longevity is its tolerance to root-rot diseases which kill red clover. It will also endure more severe winter conditions than red clover.

RESEARCH UNDERWAY ON SEED SETTING

The main weakness of zigzag clover is that it is a poor seed setter. This has restricted its use as a forage crop. An experiment was initiated at the Ottawa Research Station to find the cause of this condition and, if possible, to produce a strain with better seeding ability.

Seed yield appeared to be genetically controlled. Hand crossings proved that seed production can be increased by selecting high yielding parents. We found that the species had to be cross-pollinated. This meant the plant depended on insects to bring pollen from other plants before seed could be set. When compared

The author is with Forage Crops, Ottawa Research Station, Central Experimental Farm.

to red clover the percentage of florets pollinated was similar.

The seed yield per acre of red clover is higher than that of zigzag. One reason is that red clover has more florets per head. Another reason, red clover can be worked by both bumble bees and honey bees, whereas only bumble bees can collect nectar from zigzag because of its long corolla tubes. Sugar content of nectar in red clover is slightly higher, but not sufficient to attract more bees.

In our investigations, we found that an increasing number of bumble bees visited zigzag from the last week of July until a peak was reached in mid-August. Then there was a gradual decline. Seed yields per head followed the same general trends as bee counts, increasing until mid-August. This indicated that low zigzag seed yields are often caused by insufficient pollinators at peak flowering time.

Another drawback to seeding has been the chalcid fly. In some years it has injured as much as 38 per cent of the seed. To control this pest, we cut back the crop in the last week of May. This has increased seed production and helped disrupt the continuity of the chalcid fly life cycle. Late blooming (July), also helped seed production by increasing the bumble bee population.

Plants found growing wild in this country in isolated areas have produced little or no seed when crossed among themselves. However, when crossed with plants from other areas, they set seed quite well, indicating that each patch may have originated from a single or very few plants.

In our tests, several thousand plants were examined to obtain the best seed producers. Finally, eight were selected from Germany, France, Finland and Hungary. This group produced an average of 40-50 seeds per head and showed good forage characteristics. Further testing on seed and forage yields were carried out on both parents and progenies.

CROSS POLLINATION INCREASES YIELDS

One-year-old F_1 progeny yielded an average of 97 pounds of seed per acre which was almost four times that of the parents. This was due in part to seasonal conditions and partly to the more effective cross pollination in the progeny test. All sister plants in the parent plots were intersterile, while all the plants in the progeny plot were interfertile.

In a light soil, two cuts produced 2½-4½ tons of dry matter per acre when sown in row plots. On clay soil, when cut three times, approximately 3¾ tons of dry matter were harvested and two cuts yielded 4½ tons. Peak dry matter yield was reached the last week of June, and then there was a gradual decline. In determining the relationship of leaf to stem in hay, the ratio was 70 per cent leaves to 30 per cent stems which is quite favorable. Zigzag is slow to start in the spring and after cutting.

Stand is improved by the proper strain of inoculum. Also, if seed is not scarified, germination at times has been as low as 55 per cent. After scarification, 80 per cent of the seeds germinated.

Though chemical analysis shows that zigzag forage is similar to ordinary red clover, there has been some question as to the palatability of zigzag. But, a farmer in the Gatineau Valley (near Ottawa) has been growing this clover for over thirty years. He claims that it is relished by all classes of livestock. When we visited the field late in October, zigzag was eaten off close to the ground. New Zealand workers also claim the clover is quite palatable.

ZIGZAG STANDS DROUGHT CONDITIONS

Zigzag can withstand greater drought conditions than red or ladino clover because of its deep creeping root system. It does not appear to choke out other grasses and clovers as some creeping rooted species do. From our experience, we find that other aggressive grasses like brome will crowd zigzag out. Because it is slow to start in the spring, it gives other grasses a competitive advantage.

Zigzag will grow on many types of soil ranging from sand to hard clay. It appears to grow naturally in clay banks along streams. It will tolerate acid conditions, and will grow in certain locations where, for example, alfalfa would not thrive. We found this so in our tests. Its long fibrous root system makes the plant suitable for erosion control. Some reports claim that it will do well on poor soil. But, it has done best for us in good soil and has responded well to fertilizers, particularly phosphates and nitrogen when applied in the early stages of growth.

Seed is not yet available but zigzag clover would appear to have great possibilities as a long-term pasture species. •

1—Seed planting of zigzag clover at CDA Research Station, Ottawa.

2—A root system with creeping rhizomes like this makes zigzag more drought resistant and helps prevent soil erosion.

3—Creeping habit shown after a year's growth in heavy clay.

BODY TEMPERATURE CONTROL in animals as related to vitamin a

R. HIRONAKA

Study of comparative body temperatures, and heart and respiration rates, of fed and fasted sheep with and without supplemental vitamin A reveals latter to be beneficial.

An animal normally responds to cold by increasing its heat production through shivering and increased metabolic rate and by reducing heat loss. Thus, the animal has several mechanisms for rapidly increasing heat production to maintain body temperature. However, when there is a sudden rise in the surrounding temperature, the heat generating mechanism of the body is unable to compensate rapidly enough and body temperature may rise.

In our investigations at the CDA Research Station, Lethbridge, Alta., we studied the physiological reactions of sheep (body temperatures, heart rates, respiration rates) to a sudden rise in the surrounding temperature. The sheep were housed for 6 days in a room kept at 20° F. then moved to a room at 65° F. One half of the animals, which we called the fed group, were given their regular morning feed immediately after transfer from cold to warm; the other half, the fasted group, received no feed until the regular afternoon feeding.

NON-VITAMIN GROUP

Body Temperatures (Fig. 1, fed group) were about 1° F. below normal in the cold but rose about 1.5° F. within 2 hours after the sheep were moved to the warm. *Heart rates* (Fig. 2, fed group) were about 25% faster than normal in the cold and declined to near normal levels in about 6 hours after the sheep were moved from the cold to the warm. *Respiration Rates* (Fig. 3, fed group) declined from a normal of about 35 per minute to about 18 in the cold but increased to around 50 when the sheep were moved from the cold to the warm. We found that all temperatures and rates were normal 24 hours after the sheep were moved. Our research also revealed that the return to normal was faster when feed was withheld on the morning of transfer from cold to warm. It would appear that when the sheep were moved from the cold to warm, more body heat was generated than was required and it was not dissipated fast enough by increased respiration rate. Hence, there was a rise in body temperature. The imbalance between heat production and dissipation was aggravated by heat generated from the consumption of feed, i.e. specific dynamic action.

If the rise in body temperature, respiration and heart rate is prolonged and high enough, the animals may require veterinary treatment. We experienced this situation in an experiment when sheep fed a vitamin A deficient ration were moved from the cold into the warm. A high fever that persisted for several days was diagnosed as pneumonia that responded to antibiotic treatment.

VITAMIN GROUP

As for feeding the animals supplemental vitamin A, we found that it reduced the effect of a sudden increase in environmental temperature. The differences in *heart* and *respiration* rates and in *body temperature* between fed and fasted animals (see figures) were not as great nor as prolonged when supplemental vitamin A was fed. These effects were found in healthy sheep that appeared to be in an adequate vitamin A status.

In practice, there may be a sudden rise of the environmental temperature, such as caused by a chinook in winter, which may lead to a rise in body temperature. Feedlot operators are aware of an increase in respiratory ailments at this time. Some feeders reduce the feed offered to avoid such illness. Although this practice assists the animal in overcoming the stress of a sudden rise in temperature, it is undesirable because gains are reduced and there is a possibility of causing digestive upsets. Our results show that animals can be assisted over the stress period of a sudden rise in environmental temperature by feeding adequate vitamin A. This reduces the rise and duration of elevated body temperatures when there is a rise in environmental temperature. These results have been corroborated in the field experience of feedlot operators who have found a reduction in cases of high fever from various respiratory ailments when cattle have been fed supplemental vitamin A. •

Dr. Hironaka is an animal nutritionist, CDA Research Station, Lethbridge, Alta.

fig. 1

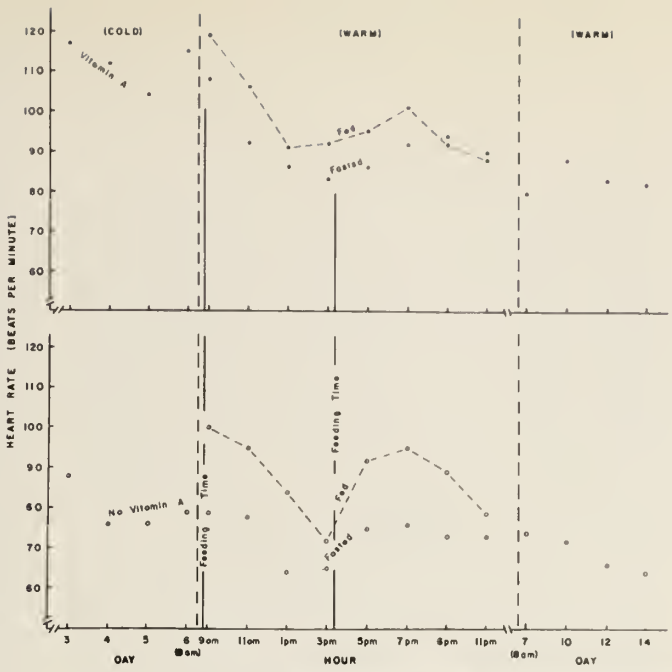


fig. 2

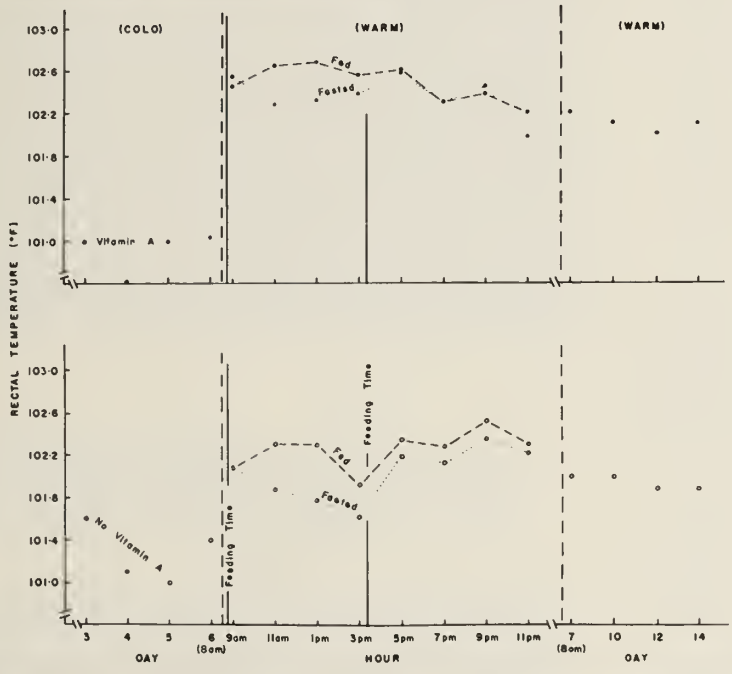
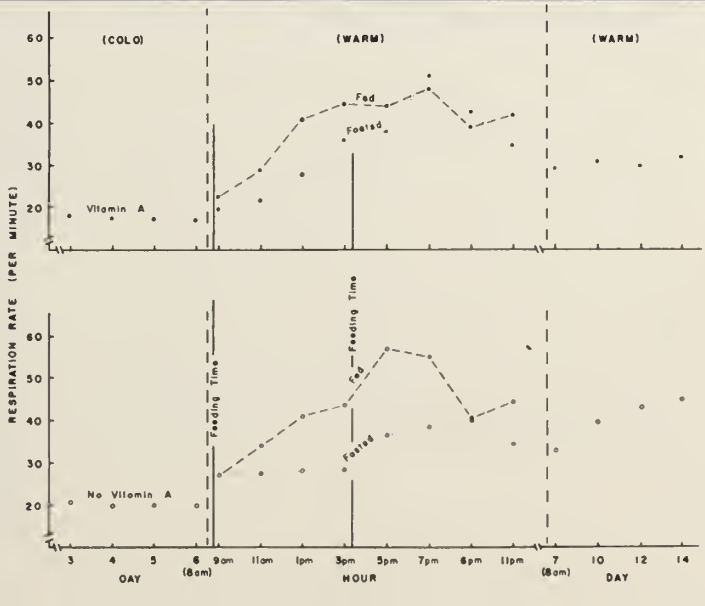


fig. 3



integrated of pear psylla

R. D. McMULLEN

In recent years the pear psylla, known as *Psylla pyricola* Förster to entomologists, has become "The Insect" to pear growers in British Columbia. This is due to the pear psylla's faculty for developing resistance to insecticides, and rising costs for new insecticides to which the pear psylla has not yet become resistant. To aid the pear grower, investigators at the CDA Research Station, Summerland, B.C. have been studying the feasibility of using predaceous and parasitic insects to control the pear psylla.

Some of the insect predators that are most abundant in pear orchards and that play a major role in reducing pear psylla populations are anthocorid bugs, certain mirid bugs and green lacewings. There are many others that generally are less common but when taken as a group also aid significantly in controlling pear psylla. Some of this second group are ladybird beetles, nabid bugs, brown lacewings, snakeflies, syrphid flies, dance flies and spiders. Also on the list of beneficial species attacking pear psylla are two tiny chalcid wasps that parasitize psylla nymphs. Unfortunately, these two tiny wasps, which otherwise could possibly control the pear psylla by themselves, have at least three species of parasites attacking them. Hence the role that they can play in controlling pear psylla is minor.

A skeptic might ask: 'If there are so many kinds of predators and parasites feeding on pear psylla, why then do pear growers have to spend so much money trying to control this pest with chemicals?' The results of research during the past two years suggest that this question may best be answered in two parts.

First, there is the matter of orchard environment. Most well managed pear orchards are planted to a grass cover crop that is mowed regularly to facilitate sprinkler irrigation and other orchard operations. The number of insect species that live on such a cover crop are relatively few and they rarely become abundant. Consequently, the numbers and kinds of predaceous species living in the cover crop are also few. In comparison, in orchards where the cover crop consists of a rank growth of several species of broad leafed weeds and grasses, such as was the general situation when ditch irrigation was widely practiced, there are a great many species of insects feeding on the cover crop and they are relatively abundant. Thus, there are a large number of predaceous species in the cover crop and they too are abundant. Most predaceous insect species feed on a number of kinds of prey. The large reservoir of insect predators in a weedy cover crop is reflected by a larger number and kinds of predators in the pear

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1—Typical grassy cover crop in pear orchard.

2—A heavy, weedy cover crop in pear orchard.

3—Dr. R. D. McMullen examining artificial overwintering sites on pear trees for pear psylla predators.

2

control

3

trees. An additional benefit of a weedy cover crop is that it affords better protection for the overwintering of predators compared to a short grass cover crop.

A cover crop that is ideal for producing large populations of predators has some drawbacks. It makes the setting of sprinkler irrigation pipes difficult and also interferes with moving ladders when picking fruit and pruning. These difficulties may be overcome by mowing panels down each row but leaving most of the weeds standing. It is also possible, but this has not been tested yet, that cutting the weedy cover crop at certain times of the season will tend to drive predators into the trees in search of prey. Another difficulty is that there are certain insects, lygus bugs and stink bugs in particular, that inhabit weedy cover crops. These species occasionally invade pear trees and cause injury to fruit. These problems related to cover crop management may or may not offset the advantages of fostering biological control agents. They will be investigated thoroughly before general recommendations for changes in cultural practices will be made.

Second, in answer to the skeptic's question, there are other pests of pear that require treatment with pesticides, and most of the pesticides used for these are detrimental to the beneficial species attacking pear psylla. For example, DDT which is recommended for the control of the fruit tree leaf roller practically eliminates all of the major predators of pear psylla except anthocorid bugs and green lacewings. This portion of the major predator complex is not sufficient to control the pear psylla. Guthion, which is presently recommended for the control of codling moth practically eliminates all species of predators. Therefore, it is apparent that part of the solution to the whole problem is integration of biological control of pear psylla with chemical control of other pests. All of the prospects for this are not gloomy. The European red mite which often is a major problem on pears is efficiently controlled by the same predators that control the pear psylla. The codling moth may be controlled by the sterile male technique in the not too distant future. In 1965, limited tests of the deleterious effects on predators of a number of insecticides were carried out. Some were relatively innocuous to most of the predaceous species. One of them, Morestan, approached the ideal. Not only was it relatively harmless to most of the predacious species, but it was also effective against psylla.

Therefore, it is not unrealistic to forecast that, through the judicious use of selective insecticides, correct timing of spray applications and the adoption of cultural practices conducive to increased predator populations, the pear psylla can be controlled more economically than by the use of chemicals alone. •

A recent Economics Branch study showed that up to 2000 acres could be sprayed from aircraft compared with less than 300 acres applied by ground crews. In this article, the author reports on another EB project—the results of a mail survey in 1965 on flying activity related to agriculture.

L. E. PHILPOTTS

Is the Canadian farmer making greater use of aircraft to increase agricultural efficiency?

According to an Economics Branch mail survey in 1965, answered by commercial and private aircraft operators in Canada, we found that there is a definite trend toward streamlining agriculture from the air. Last year, flying activity related to agriculture, was done by a total of 286 private and commercial operators who used 393 aircraft.

Agricultural aerial spraying kept 150 aircraft busy spraying, seeding and fertilizing land in 1965. This took care of 96 operators that year which was an increase of 12 per cent over 1961 and 56 per cent more than the first survey conducted in 1957.

In 1965 about 1,088,613 acres of agricultural land was sprayed in Canada (see table). This was 63 per cent higher than 1961 and was 150 per cent more than 1957.

Though agricultural spraying was the main flying activity related to agriculture, many aircraft were used for management purposes on the farm and for aerial photography.

We found that most of the agricultural aerial spraying in 1965 was carried out in three areas, Ontario, British Columbia, and Prairie Provinces, with relatively small amounts done in Quebec and New Brunswick.

The 96 operators, using 150 aircraft, carried out aerial spraying specifically for weed and plant disease control, insect control, brush control, fertilizing, and seeding in 1965. There were a total of 50 commercial and private operators in Saskatchewan alone.

Just over 11,465 flying hours were reported by commercial and private operators for agricultural spraying, fertilizing and seeding. Of this amount, 9,260 were flown in the Prairie Provinces. The greatest number of hours were spent in spraying for the control of weeds. Over 7,756 hr. were flown by aircraft in this type of work.

The land sprayed from the air in the Prairie Provinces consisted mostly of grain crops, improved and unimproved pasture land. In British Columbia, Ontario, Quebec and New Brunswick, high-value truck crops and orchards were principally involved.

It took 11,400 hr. to spray more than 1,088,000 acres of Canadian farm land in 1965. In different parts of the country the number of acres sprayed per hour varied. In the Prairie Provinces, the average number of acres sprayed for the control of weeds was 105 acres per hour. Privately operated aircraft flew an average of 115 acres per hour for weed control.

The rate of spraying, for weed and plant disease control, in British Columbia and Ontario was considerably less. This was probably due to smaller fields, rougher terrain, urbanization and limited airstrip facilities, which tend to increase ferrying time. In these Provinces the average number of acres sprayed per hour was about 50.

Commercially operated aircraft in all of Canada covered about 50 acres per hour for insect control.

How much chemical was used? It was estimated that well over 460,000 gal. of herbicides were sprayed; 185,000 gal. of insecticides sprayed and 13,500 lb. dusted; over 99,000 gal. of chemicals utilized for brush control; and over 16,000 gal. of fertilizer were sprayed and 80,000 lb. dusted in Canada by both the commercial and private operators. In addition, the commercial operators in the Prairie Provinces seeded 55,600 lb. of grass seed.

The cost spread was wide. Here are some examples: Custom charges, including charges for aircraft and chemicals, to the farmers in British Columbia and

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STREAMLINING AGRICULTURE FROM THE AIR...

Ontario for weed control ranged from $1.00 to $8.50 per acre. Commercial operators charged an average of about $1.00 for this type of work in the Prairie Provinces where the rates ranged from 80 cents to $1.35. When more expensive chemicals were used, the rate in the Prairie Provinces was as high as $4.50 per acre.

The average custom charge of the private operators for the spraying of weeds in the Prairie Provinces was considerably lower than the rates charged by the commercial operators. The lowest rate was 55 cents and the highest was $1.10.

The commercial rate for insect control in the Prairie Provinces was just over $2.00 per acre. In British Columbia, Ontario, Quebec, and New Brunswick, the average charge to the farmer for the control of insects on cropland was about $4.80 while that on orchards averaged $6.50. These charges varied according to type of chemical as well as to environment. They ranged from $3.55 to $8.50 and from $5.90 to $7.20 per acre for cropland and orchards, respectively.

The average charge to the farmer by commercial operators for fertilizing cropland was about $7.85 per acre in British Columbia and Ontario. The rates ranged from $5.80 to $9.15 per acre. Data on charges for fertilizing were incomplete for both commercial and private operators in the Prairie Provinces.

Commercial operators in the Prairie Provinces charged the farmer an average of $2.60 per acre for brush control, while private operators charged an average of $2.80 per acre. The rates ranged from a low of $1.00 to a high of $6.00.

Many farmers and ranchers reported using aircraft as part of their farm or ranch operations. In their replies, they indicated that the aircraft were used to replace many jobs done previously by trucks, cars and other modes of travel. These jobs were done for neighbor farmers as well. About 30 different activities in the fields of agricultural transportation, supervision and inspection were reported by both private and commercial operators.

A total of 223 private operators flew 234 aircraft, and 29 commercial operators used 69 aircraft for agricultural purposes other than spraying. Many of these operators also participated in agricultural aerial spraying. The main purposes for which these aircraft were flown can be grouped as: (1) transportation, (2) supervision and inspection, and (3) miscellaneous. A clear distinction between agricultural work and recreational flying was not made by many of the farmer-aircraft-operators who returned questionnaires.

The total number of hours flown by the 303 private and commercial aircraft for agricultural transportation, agricultural supervision and inspection, and for recreation and other types of flying was 17,400. About 41 per cent of this total flying related to agricultural work.

In addition to the operators who carried out agricultural spraying and other agricultural work, two aerial photographic survey companies used nine aircraft to photograph 28,800,000 acres in Canada. This work was carried out in connection with soil surveys, socio-economic studies and extension activities. •

USE OF AIRCRAFT IN AGRICULTURAL SPRAYING BY TYPE OF OPERATION, CANADA, (EXCLUDING NEWFOUNDLAND), 1965

Type of Operation	Acreage Treated	Per Cent of Total
Weed Control	895,895	82
Insect Control	116,775	11
Brush Control	60,136	6
Fertilization	9,547	1
Seeding	6,260	
Total	1,088,613	100

ECHO

NOTES AND COMMENTS FROM THE FIELD

CEREAL LEAF BEETLE IN CANADA—During the 1956 Canadian survey for the cereal leaf beetle, only one was captured—near Harrow, Ont. However, American entomologists, more experienced with the pest, believe that it may be more widespread in Ontario than indicated by the survey.

With growing infestations in nearby Michigan and Ohio, there is every reason to expect that the insect will soon be damaging Ontario cereal fields. Because it is a strong, high flier, it may appear some distance inland from the international boundaries.

If you see either the insects or damage caused by them, please report this at once to your nearest insect laboratory.

To prevent their build up and spread, controls should be applied to any insects found.

Two relatively safe insecticides have been used successfully in the United States. They are:

(1) *Carbaryl* (Sevin)—effective against all active stages of cereal leaf beetle and may be used up to one day before harvest or pasturing. Use one pound actual carbaryl per acre. That is:

50 per cent carbaryl (Sevin) wettable powder, 2 lb. per acre.

85 per cent carbaryl (Sevin) wettable powder, 1 1/5 lb. per acre.

Carbaryl is more effective if used with a sticker.

(2) *Malathion*—Particularly effective against the beetles. Do not harvest or pasture crops treated with malathion for seven days after application. Use 1 lb. actual malathion per acre. That is:

50 per cent malathion emulsible concentrate 1¾ pt. per acre.

25 per cent malathion wettable powder 4 lb. per acre.

There is also a new concentrated form of malathion which must be applied by specially equipped aircraft or ground sprayers.

For further information consult your nearest Insect Laboratory or Agricultural College.

This year the CDA Plant Protection Division is conducting a survey in Essex and Chatham Counties.—G. F. MANSON, CHATHAM, ONT.

TILLAGE TO ERADICATE COUCHGRASS—Tillage alone during a one-day period will eliminate couchgrass in the Peace River area. However, the procedure is exacting. Use of a rotovator is recommended, but a one-way disc or heavy duty disc harrow will also do the job.

Eight or nine workings are needed, the first just before freeze-up of the first year. The ground must be tilled each time there are two inches of re-growth. A week's delay, particularly if it occurs early in the season, could cause failure to obtain control.

For the method to be successful, both weather and farm management must be good. An extremely wet or dry summer is unsuitable, because a moist soil is needed to sprout the couchgrass rootstocks so that they can be killed by tillage. Such seasons are abnormal, however, and the method will usually be successful.

One warning: elimination of all couchgrass from a field does not mean that it is now free of the weed. Dormant seed will germinate and seedlings must be disposed of by follow-up tillage. This can be worked into standard cropping procedures.—A. C. CARDER, BEAVERLODGE, ALTA.

CORN IRRIGATION—The best combination of irrigation treatments and planting rate at this station increased yields of shelled corn grown on Fox sandy loam soil by 70 bu/acre.

When 16,000 plants per acre were grown as usual, production was 108 bu/acre. Adding irrigation water three times, to a total of 11 in. increased yield to 145 bu/acre.

Applied to 22,000 plants per acre, an equal amount of irrigation water increased yield to 177 bu/acre.

Last year's project was preliminary. A formal project has been initiated this year, with treatments modified to conform with results last year.—J. M. FULTON, HARROW, ONT.

DÉSINFECTION DES PLANTEUSES DE POMMES DE TERRE—Compte-tenu des conditions très favorables à l'expression des symptômes de la flétrissure bactérienne en 1965, la désinfection des planteuses gravement contaminées par la flétrissure bactérienne des pommes de terre à l'aide de jets de vapeur à 100 livres de pression durant 5 minutes a de nouveau donné une récolte exempte de maladie—H. GÉNÉREUX, LA POCATIÈRE, P.Q.

INSECTICIDE FOGGING MACHINE EFFECTIVE—Recently the effectiveness of an insect fogging machine was demonstrated at the CDA Research Station, Winnipeg. Floors and walls of empty grain bins must be treated with insecticides so that newly-stored grain will not be infested with insects, and bins with high walls cannot be properly sprayed with pressure or power sprayers. The insecticide fogging machine offers an alternative and, in this case, the area dealt with was a 19-foot high elevator annex bin with a capacity of 5,800 bushels of wheat.

In 20 minutes, a gallon of insecticide, made up of 0.13 percent pyrethins and 1.27 percent piperonyl butoxide was applied from an electric fogger placed at the center of the floor. The efficiency and uniformity of the treatments were tested with insects put on the floor, at the top, and on the four walls of the bin. The effectiveness of residual deposits was determined by using glass, plywood and filter paper surface. Panels of grooved plywood were used to see whether the insecticide fog could penetrate cracks in wood.

All test insects placed in exposed locations on the floor of the bin were killed. Mortality rates of insects suspended in containers were: 100 per cent on three walls; 80 per cent on the fourth wall and 71 per cent 19 feet above the floor.

Residual deposits of insecticides were left on all inside surfaces including simulated wall cracks. Deposits on horizontal surfaces and plywood panels were more poisonous than those on glass and filter paper surfaces.

Incidentally, the fogger can be turned on and off by hand, so that there is no danger of personal exposure while the insecticide is being applied.—F. L. WATTERS, WINNIPEG, MAN.

BROMEGRASS TESTS AT NAPPAN—Five bromegrass varieties were seeded at this station, both alone and with "Vernal" Alfalfa. These were "Achenbach", "Lincoln", "Fischer", "Saratoga", and "Canadian Commercial".

The grass plots received 75 lb/acre of nitrogen in the spring, and all plots 1000 lb/acre of 0-20-20 after the first cut. All were harvested when the bromegrass was fully headed out.

The results: Only 3 days difference in maturity between the earliest heading varieties "Fischer", "Canadian Commercial" and the latest, "Achenbach." No important difference in yield between varieties seeded alone or those seeded with alfalfa. There was a difference in in-vitro digestibility of 4.4 per cent between "Fischer", the highest, and "Saratoga", the lowest, but this was not significant. In-vitro digestibility of the same varieties grown with alfalfa showed even smaller differences.—J. E. LANGILLE AND F. W. CALDER, NAPPAN, N.S.

Three-year-old peach tree in linuron—paraquat herbicide cocktail plot

HERBICIDE "COCKTAIL" FOR PEACH TREES—Peach growers can now rid their young orchards of weeds by using a "herbicide cocktail". It is composed of linuron and paraquat, two herbicides which have been registered for use together for the 1966 growing season. Registration was based on results of three years of research on weed control in young peach orchards at the Harrow station.

Labor costs make weed control by cultivation and hand hoeing expensive for growers. Also, cultivation can cause tree injury, resulting in reduced growth and greater risk of peach canker infection.

Studies here showed that young, non-bearing peach trees are extremely sensitive to competition from weeds. Growth of year old trees exposed to this competition was reduced 93 per cent and their leaf nitrogen 27 per cent, compared with trees of the same age in areas treated with the herbicide mixture. One application of the mixture in May kept treated areas free of weeds for the remainder of the growing season.

Recommended amounts for the "cocktail" are: Eight lb. of linuron (as taken from the container) and two to four qt. of paraquat per acre. Apply in 40 to 100 gal. of water as a directed, low-pressure spray. Treat an area extending about three feet out from the tree trunk before weeds are four inches high. Avoid spray contact with tree foliage or green bark.

It must be emphasized that the mixture can be used only under trees established for more than one year. To control weeds around younger trees, apply paraquat repeatedly, but be sure to follow carefully the directions on the label.—W. J. SAIDAK, HARROW, ONT.

LA TACHE ARGENTÉE DES POMMES DE TERRE—Trois années d'essais ont démontré que le champignon causant la tache argentée des pommes de terre, *Helminthosporium atrovirens*, est apparemment absent des sols nouvellement défrichés. Ces essais accroissent l'importance de la semence comme source d'inoculum de cette maladie et laissent entrevoir la possibilité qu'elle puisse se transmettre aux nouveaux tubercules par la croissance du pathogène dans la partie souterraine de la tige et dans les stolons.—J. SANTERRE, LA POCATIÈRE, P.Q.

POTATO SILVER SCURF DISEASE—Three year trials at this station show that virgin soils such as land recently cleared of trees are apparently free from *Helminthosporium atrovirens*, the causal agent of silver scurf of potatoes.

The infected seed appears to be the most important source of inoculum. Results suggest that this disease could also be transmitted to daughter tubers in the soil by the fungus invading the tissues of the underground part of the stem, then the stolons and, finally, the tubers.—J. SANTERRE, LA POCATIÈRE, P.Q.

DIELDRIN RESIDUES IN MILK—A group of 36 dairy cows known to have high levels of pesticide contamination were moved to the Agassiz, B.C., farm in March, 1965, for studies of dieldrin levels in milk and rates of excretion on different feeding programs. Cows were allotted to three treatments: (1) alfalfa hay at 2 lb. per 100 lb. body weight per day plus concentrate at 1 lb. to each 4 lb. of 4 per cent milk produced; (2) 5 lb. alfalfa hay per day and concentrate-free choice; (3) alfalfa hay only.

Cows on treatment two ate up to 35 lb. per day of concentrate, and on treatment three, cows ate up to 56 lb. per day of hay. Cows on dieldrin-free feeds showed a decline in excretion level of dieldrin in milk from 0.4 ppm of milk fat to less than 0.1 ppm within six weeks. The rate of decline was the same on all three feeding programs.—D. M. BOWDEN, AGASSIZ, B.C.

FLÉTRISSURE BACTÉRIENNE—Parmi les semis du Maine, éprouvés pour leur résistance à la flétrissure bactérienne, les semis suivants: B766-E, B3478-45, B3201-38, B725-61, B725-1, Wy 1122, B3352-8, B3478-23 et B4878-7 ont donné des tubercules exempts de symptômes de la maladie. L'examen microscopique d'empreintes faites au talon des tubercules indique que les semis F725-61 et B4878-7 étaient exempts de bactéries de la flétrissure bactérienne.

Après divers tests en serre et en champ, les tubercules issus du semis B725-61 n'ont pas transmis la maladie à une variété de pomme de terre sensible. Ces résultats indiquent que ce semis est très résistant, sinon immune, à l'organisme responsable de la flétrissure bactérienne.—H. GÉNÉREUX, LA POCATIÈRE, P.Q.

PACKAGE BEES TRANSMIT A.F.D.—Package bees shaken from colonies infected with American foulbrood disease in Southern British Columbia were fed sugar syrup enroute and installed 2-4 days later in clean equipment with new frames and foundation. Six weeks later 4 out of 6 colonies showed A.F.B. disease symptoms.

Previously it had been considered that 24 hours after shaking, the disease could not be transmitted by bees. These results indicate that care by shippers in prior inspection of colonies and preventative treatment with antibiotics when installing package bees are required.—P. PANKIW, BEAVERLODGE, ALTA.

DIFFERENT TICK FOUND ON EASTERN ANIMALS—Recently the species *Ixodes texanus*, a close relative of the small brown tick *Ixodes cookei*, which infests many Eastern Canadian ground hogs, skunks, raccoons and foxes, has been found on these animals.

The relative had been reported only twice before from Ontario: from a mink farm in 1946 and on a raccoon in 1949. All other Canadian distribution records show that it normally occurs in British Columbia.

I. texanus has now been found on 12 raccoons, one fox and one skunk in various parts of Southern Ontario. It has apparently become well established in the wildlife population of that area, and may prefer the common raccoon—W. A. WEBSTER, HULL, P.Q.

B. B. CHUBEY

The carrot industry has found to its dismay that 'beauty is but skin deep'. When the bright attractive orange roots discolor or brown they are unattractive and therefore unacceptable as a fresh market vegetable. In studies at Morden, we have shown that browning of carrots is confined strictly to the epidermal layer or skin of the roots. All traces of the brown areas were removed by peeling off the skin layer. However, the housewife is not aware that the discoloration is only skin deep and thus will purchase only the product which has an attractive appearance. Accordingly, it is important that the producer market a product not affected by discoloration. Carrot browning has been a continuing problem in Manitoba for several years and, indeed, since carrot production became a commercial enterprise.

CARROT BROWNING

WHY IT OCCURS AND MANAGEMENT AND STORAGE PRACTICES THAT REDUCE THE PROBLEM.

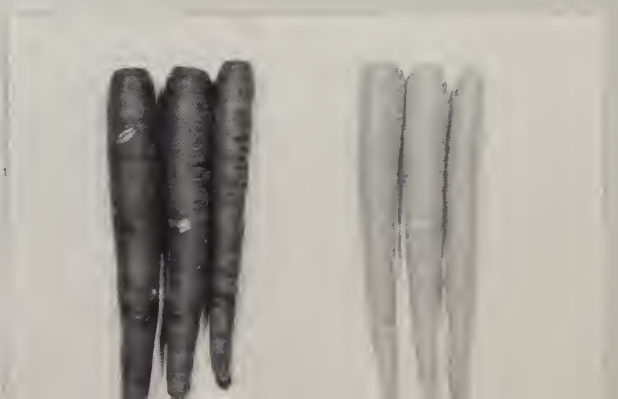
Carrots discolor more intensively after several weeks of storage. Carrots grown in northern areas must be stored for winter use and must retain a desirable quality and an attractive appearance to compete successfully with imported carrots from areas where they are grown outdoors in winter. The browning problem has markedly suppressed production of carrots for winter consumption.

Carrots, like many vegetables and fruits, are endowed with a natural protective mechanism against the invasion of disease organisms. This mechanism involves the formation of scar tissue of which melanin, a brownish pigment, is the major chemical component. Melanin is produced by enzymatic oxidation of phenolic compounds. Whenever the epidermal cells of the carrot roots are damaged, the cell contents are exposed to atmospheric oxygen resulting in melanin formation and browning. Thus, three components must be present for the browning reaction to occur, namely, substrate, enzyme and oxygen. This fact provides a basis for control of browning. All existing varieties of carrots possess large amounts of phenolic compounds, the required substrate, as well as the enzyme system. Chromatographic separation of carrot tissue extract at Morden revealed the existence of a minimum of twelve different phenolic compounds. Four of these caused browning when they were acted upon by the required enzyme. Of the four, chlorogenic acid was found as the phenolic compound in greatest abundance in the carrot tissue and considered to be the principal browning substrate.

The substrate or phenolic compound and the enzyme system are integral components of the cell contents. We observed that the cell must be ruptured to allow its contents to come in contact with atmospheric oxygen before browning will take place. Accordingly, injury to the cell is imperative for browning to occur and any technique which prevents cell wall disruption will prevent the discoloration. Keeping carrots in a humid atmosphere forms a moist layer on the surface of the carrot roots and thus functions as an oxygen barrier and helps prevent browning. Also, under humid conditions, the skin layer does not crack as it does under dry storage conditions. Furthermore, low temperature in storage inactivates enzyme activity and further helps to prevent browning.

Chemicals will also prevent browning in carrots by acting as antioxidants or enzyme inhibitors. These are widely used by the vegetable and fruit processing industry, but thus far have not been applied to fresh vegetables. The preventive use of chemicals in carrot browning requires further study in order that it may be found possible to comply with the requirements of the Food and Drug Act. Also, little is known of the economy of their use with fresh vegetables. Good cultural practices, when growing carrots in the field and handling at harvest, are the only preventive means presently available to the carrot grower. For prevention of carrot browning, the important thing is to employ extreme caution when handling carrots to avoid bruising and to provide cool and moist storage conditions. •

Carrots after two months storage. Left: Carrots showing typical discoloration following surface bruising; Right: Unbruised carrots retain an attractive appearance.



The author, who has been a specialist in vegetable nutrition at the CDA Experimental Farm, Morden, Man., recently joined the Green Giant of Canada Limited.

SEMI-MECHANIZED MACHINERY FOR TOMATOES

PRELIMINARY REPORT

L. G. DENBY

Small tomato growers who farm 5 to 10 acre plots can look forward to brighter days with semi-mechanized planting-harvesting machinery custom designed to work double row plantings.

In our investigations at the Summerland Research Station, we have conducted preliminary tests on developing mechanical equipment to plant and harvest the tomato crop from double-row plots.

Difficulties in harvesting tomatoes grown in B.C.'s Okanagan Valley have increased in recent years due in a large part to the shortage of stoop labor. High employment in other industries, reduction in numbers of suitable stoop laborers, and welfare benefits have all added to costs of harvesting the cannery crop each season. Costs of harvesting rose as high as 30 cents per 40 pound box or $15 per ton in 1965, despite which much of the crop was lost due to insufficient pickers.

Single-row planting presented another problem. Much of the tomato acreage is planted with single-row wheel-type planting machines. These machines take 3 men (1 tractor driver plus 2 men inserting plants) per single row, and travel at the speed of approximately 2 m.p.h. Even if planting is straightforward and involves a minimum number of turns per acre, these machines will plant approximately 1 acre per hour, and require 3 man-hours labor per acre.

The answers to these problems were found in developing suitable machinery for planting and harvesting tomatoes, and in changing from single to double row tomato planting. There was no question about the advantages of switching from single to double row. For example, single rows of tomatoes grown in test plots at Vernon, B.C., in 1964 produced 13.28 tons per acre compared to a marketable yield of 18.37 tons per acre from double row plantings. The harvest was made on September 29, 1964. The variety grown: Summerdawn.

In 1965 we decided to make efforts to design and build prototype machinery to both plant and harvest tomatoes in double rows. The planting was similar to the successful tests used at Vernon the previous year. Double rows were spaced 2½ feet apart, with 2 feet between plants in the rows. Spacing between the double rows was 5 feet. The same Summerdawn variety was planted.

The author is Head, Vegetables and Ornamentals Section, CDA Research Station, Summerland, B.C.

THE PLANTING MACHINE

The planting machine was built as a two-wheeled trailer assembly which could be drawn by a standard field, row or orchard crops tractor (Fig. 2). A set of spring-tooth cultivators was mounted on the front of the planter, directly behind the tractor (Fig. 3). The teeth served to loosen up tractor wheel tracks, and eliminated all weeds germinated since final land preparation. It also loosened the soil to aid operation of the furrowing tools.

A two-hundred (Imp.) gallon tank was mounted slightly forward of the wheels of the trailer assembly. Separately valved hoses led from this tank, one hose to each row to be planted. The hose let water or preferably starter solution run down to the root zone of each transplant during planting.

The design kept worker comfort in mind. At 6 to 8 inches above the ground a well-padded kneeling platform carried the personnel. A wide padded belt attached at the front of this platform passed under the arms to lend support across the chests of the planters.

The implements in the planting operation consisted of modified plough or furrowing tool designed to open furrows about 5 to 6 inches wide and approximately 3 inches deep in the soil previously loosened by the front mounted spring teeth. The starter solution tubes were firmly fixed to the furrowing tools so that the solution ran to the bottom of the furrows. (Figs. 5 and 6). Behind the furrowing tools, at a distance of 3 to 5 inches, hilling tools followed the openers and turned the loose soil back into the furrows. These were set to hill the soil up to a height of 3 inches or so above the original ground level.

The spacing of plants in the row was determined by a series of trip devices affixed to a false rim on one wheel of the trailer. These tripping devices activated a clapper which rang a gong as a signal to the planters to insert a plant. One tripper on the wheel rim sounded the gong once per revolution of the wheel. Closer spacing was obtained by adding trippers at equal distances around the false rim. Actual planting distances, therefore, were dependent on the outside circumference of the tire.

Planting operated smoothly when the machine was in motion. The tractor was set to a slow but steady speed. Starter solution valves were opened. Front mounted spring teeth pulverized the ground behind the tractor. Furrowing tools opened the furrows, starter solution flowed into the bottom of these furrows. The planters kneeled on the platform, arms over the support belt, and had eight or ten plants in one hand (Fig. 7). These plants were fed one by one to the free hand. At the sound of the gong planters placed the roots of the transplant in the starter solution in the furrow. The furrow closures were set close enough to

the openers so that the soil rolled back into the furrow, gripping the plants which remained upright and passed between the closures under the kneeling platform. As soon as the plant was gripped by the soil, the planter moved his planting hand up a few inches to grasp the next plant ready in the fingers of his feeding hand.

The planting machine proved versatile. Rows could be placed as close together as 18 inches, limited only by working distance required by the planters. The number of rows planted at one pass depended on the width of the machine, the number of furrowing tools used, and to a lesser extent on the size of the starter solution tank. In any event, the ratio remained one planter per row, with one tractor operator per crew regardless of the number of planters involved.

The machine performed well. Rows were as straight as the tractor operator could drive. Rate of travel was dependent on the spacing required within the row. At a spacing of two feet between plants, an operating speed of approximately 2 m.p.h. proved comfortable for the planters, once they became accustomed to the operation.

One critical factor was exhaust from the tractor, which had to be elevated sufficiently so at no time were the planters subjected to fumes. Protection from excessive sun and rain showers could be provided readily by means of an overhead canopy, so the planting operation could continue as long as the soil remained friable enough to be worked.

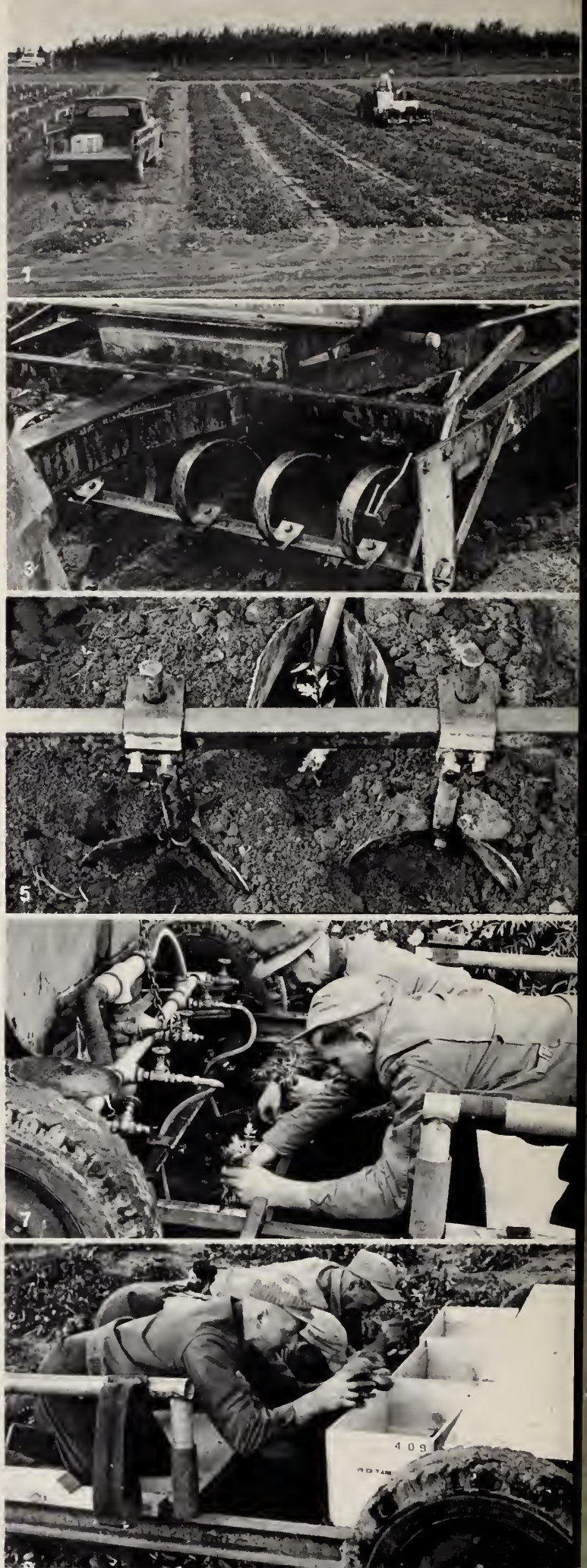
THE HARVESTING MACHINE

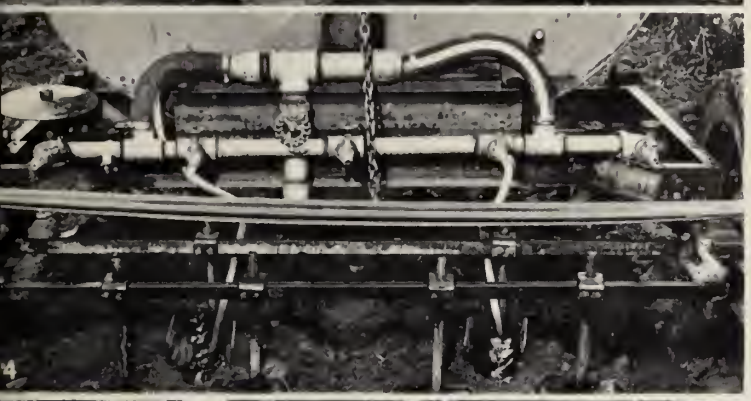
The density of the crop in the double-row plots at Vernon in 1964 prompted us to consider developing some form of mechanical aid to speed up harvesting of the cannery crop.

As the 1965 season progressed, advantages of such a machine became even more evident, particularly when a much higher proportion of the crop obviously was going to be too late for fresh market harvest.

The harvesting machine was developed from the prototype planting machine. It consisted of the same trailer used for planting. (Fig. 8). The water tank and hoses were removed, and a plywood deck was fastened on in its place. The tool bars and attachments, and the front spring-teeth were removed and the spacing bell was disconnected. The kneeling platform and rubber supporting belt were left intact. A low platform sufficient to hold 3 apple boxes end to end was constructed about 24 inches ahead of the kneeling platform.

Three pickers mounted the kneeling platform, arms over the belt, and the height was adjusted to allow their hands to reach the ground well ahead of their bodies. (Fig. 9). The trailer was attached to an orchard tractor with front and rear wheels extended to full spread (56





1—Double-row plots of Summerdawn at Summerland in 1965.
2—Trailer-type planting unit.
3—Close-up of front mounted spring tooth.
4—Rear view of planting machine. Note system of shut-off valves and hoses for distributing starter solution to base of transplants.
5—Close-up of furrowing and closure tools. Transplant is being gripped and held upright by hilled soil.
6—Side view of furrowing and closing tools, and location of the transplant.
7—Position of planting personnel on kneeling platform, belt under chest. Transplants held in one hand and fed to the other. Planter inserts them into the furrow ahead of the backfilling soil.
8—Planting machine converted for harvesting operation.
9—Three pickers in kneeling position, resting over cross-belt, picking one double-row.

inches clearance between the wheels). Tractor and trailer unit straddled a double row, and progressed as slowly as possible (less than one m.p.h.) with frequent pauses as the pickers signalled inability to keep pace. The 3 pickers picked off the double row (spread of 6 feet), placing the fruit in the apple boxes. When full, the boxes were transferred by hand to pallets on the deck of the trailer and replaced with empties.

A comparison between mechanical and conventional harvesting methods was made on alternate rows in the same plots. Every other row was picked using the harvesting machine. The same crew harvested the remaining rows using the standard stoop method, picking into pails and transferring into boxes for later pickup. The comparison in the study involved only the time required to pick the fruit and place it in the boxes. The efficiency of the two methods was based on pounds of fruit picked per man per minute, excluding the pick-up crew in the standard method, and the tractor driver in the trailer method.

Weights picked were determined by actual weighing, taring for the boxes. The average weights on four plots using the standard stoop method, hand to pail to box, were averaged at 5.38 lb./man/min. The same crew, on adjacent rows using the trailer method, picked an average of 11.08 lb./man/min.

OTHER FINDINGS FOR FUTURE USE

It was found that the maximum span of the tractor wheels was not sufficient to completely clear the double or matted rows. One way around this would be to decrease the distance between the double rows from 2½ to 2 feet, and to increase the spacing between plants within the row from 2 feet to 2½ feet. This would also facilitate the planting operation by enabling the machine to move forward somewhat more rapidly.

The machines as outlined in this article are crude prototypes. The main purpose of this preliminary work was to investigate the principles involved. More elaborate machines can be designed which, if not self-propelled, at least would be closer coupled, and so would reduce the turning radius and increase the manoeuverability of the equipment.

For both planting and harvesting operations, a self-propelled unit designed to maintain very slow speeds (¼ to 3 m.p.h.) would have distinct advantages. Despite creeper gears, most tractors are incapable of maintaining speeds slow enough to accommodate the harvesting operation in a heavy crop, without severe strain on the tractor clutch.

A self-propelled unit, incorporating the principles outlined, is under construction for trial later this year, is in co-operation with A. D. McMechan, agricultural engineer at the Summerland Research Station. •

MEASURING TOMATO CRACKING

PETER W. VOISEY AND L. H. LYALL

Cracking in tomatoes (Fig. 1) a problem that plagues both producer and plant breeder, generally occurs when it rains after a long dry spell. This condition allows the entry of bacteria which results in lower grade crops. Since tomato varieties have different degrees of susceptibility to cracking the plant breeder has a challenge to meet in developing new crack-resistant varieties and still retain other desirable features, such as yield and fruit size.

Researchers who have been investigating the inheritance of cracking resistance for many years have yet to hurdle the serious obstacle of how to objectively (mechanically) rate a variety for cracking. The oldest method of evaluation is field observation after natural cracking conditions have occurred. A skilled observer can rate one variety against another and produce an index. This method, however, is of little use if cracking conditions do not occur during the growing season. This leaves the breeder not knowing how susceptible his varieties are and a year's research is partly wasted. Furthermore, another factor has to be considered, namely that in a segregating population of two varieties, crossed for breeding purposes, the cracking behaviour of each plant is theoretically different. Each plant must therefore be rated so that only those most resistant are selected.

Cracking is generally considered to be governed by several genes, making it possible to select, genetically, resistant lines. Tomato skin cracks because the con-

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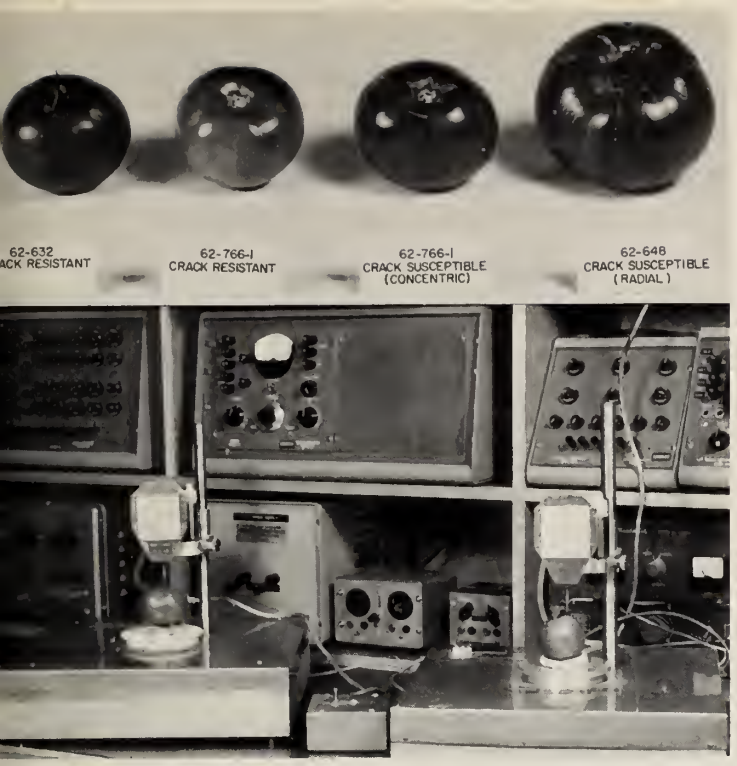

1—Tomatoes showing resistance and susceptibility to cracking.
2—Puncture testing tomatoes in the laboratory.

tents of the fruit outgrow the skin, stretching the skin until it breaks. Thus, when a sudden uptake of water occurs after a dry spell the tomato skin cracks, some varieties radially around the stem-end scar, others concentrically, while some varieties have both types of condition. Theoretically, cracking is governed by skin strength but experimental evidence in the past has not proved this theory.

Engineering Research Service has been cooperating with the Ottawa Research Station to develop a mechanical method of measuring the cracking resistance of tomatoes. In our investigations to date, we have found that cracking is governed by skin strength but the relationship is not clear cut. Other factors such as plasticity appear to have some influence. Our experiments show that skin strength (i.e., a combination of skin thickness and skin toughness) is related to cracking. Our research revealed that one of the easiest methods of measuring skin strength is by a puncture test (Fig. 2) where the force required for a small probe (1/16" diameter) to penetrate the skin is recorded.

In our studies we established a definite relationship between cracking behaviour and this measurement. We found that a variety can be rapidly tested by recording 30 fruit. We are continuing our studies to see if the method can be used to select the most resistant plants of a cross. The method shows promise and will speed up breeding programs.

For example, we tested three established varieties by the puncture method to show how puncture resistance and cracking are related (Table 1). The variation between individual fruit within each variety is high but the differences between mean puncture values for each variety are nevertheless highly significant. We also found a significant correlation between puncture resistance and cracking behaviour in several other tests with eleven other varieties.

The variation within a variety is caused by natural differences between fruit due to different exposure to the weather, shading by leaves of the plant, soil conditions from plant to plant, and growth and development factors. The fact that the puncture tester is sensitive enough to measure these differences leads the authors to believe that the method will be successful in selecting crack resistant fruit from a cross.

The new method has opened a wide area for the study of the influence of different factors such as nutrition, irrigation, fruit development and meteorological conditions on cracking behaviour. The puncture tester has also been used to measure the tenderness of the pericarp of sweet corn and the authors found it could be used as a mechanical method to replace the bite test normally used. •

TABLE 1—MEAN* PUNCTURE RESISTANCE OF VARIETIES TESTED (GRAM)

Variety	Cracking behavior**		Puncture resistance	
	R	C	Aug. 20	Sept. 9
Scout.....	0.00	0.00	290.4	291.5
Rideau.....	1.40	0.30	253.9	246.2
Moreton Hybrid.....	4.50	0.50	202.5	207.5

* Mean of six replicates of 30 fruit, two readings per fruit (360 puncture readings).

** Radial and concentric cracking behavior based on 3 years' visual estimates, rated 0 to 5.5 highly susceptible.

EFFETS DE LA NOSÉMOSE SUR LE RENDEMENT EN MIEL

J. C. M. L'ARRIVÉE

Dans plusieurs régions du monde la production du miel est plus ou moins limitée par la présence de *Nosema apis* Zander, un parasite intestinal de l'abeille adulte, *Apis mellifera* Linnaeus. De nombreux savants ont démontré que la nosémose diminue la production de couvain ainsi que la durée de la vie des butineuses; c'est alors que le rendement en miel sera diminué.

Les pertes causées par la nosémose semblent de plus en plus préoccuper les apiculteurs de l'Amérique du Nord. Auparavant, la nature insidieuse de la maladie leur échappait. Le coût relativement élevé de la drogue fumagilline peut aussi être un facteur important d'indifférence. Aujourd'hui cependant, les apiculteurs avertis s'aperçoivent qu'en enrayant la maladie ils augmentent la rentabilité de leurs ruches.

En 1964, à la Ferme expérimentale de Brandon (Man.) nous commencions une étude en vue de déterminer les effets de la nosémose sur le rendement en miel dans les colonies d'abeilles.

MATÉRIEL ET MÉTHODES

A la mi-avril 1964, nous importions du sud des États-Unis 50 paquets contenant chacun environ un kilogramme (2.2 livres) d'abeilles. Pour notre étude nous avons choisi 36 paquets d'abeilles exemptes de nosémose et nous les avons établies.

Les colonies ont été divisées en quatre groupes. Chaque colonie a reçu un demi-litre de sirop contenant 0;40,000; 200,000; et 1,000,000 de spores de nosémose au ml. Les groupes étaient distancés d'environ 200 à 300 mètres. En vue de prévenir les égarements, des plaques colorées furent placées sur le devant des ruches disposées en «fer-à-cheval».

Après la première semaine et environ tous les dix jours par la suite, nous avons retiré de chaque colonie un échantillon composé de 25 abeilles. Dans tous les cas nous recueillions des butineuses dès qu'elles atterrissaient sur le plateau de la ruche parce que, d'après notre expérience, ces abeilles devaient être plus contaminées et permettre une meilleure appréciation du degré d'infection de la colonie.

Nous avons broyé l'abdomen des abeilles avec un peu d'eau et tamisé le mélange à travers un morceau de nylon puis, le volume du liquide fut amené à un ml par abeille. Une goutte du mélange fut placé sur un hémacytomètre et les spores comptées sous la lentille d'un microscope grossissant 440 fois.

A la fin de la saison nous avons obtenu le rendement net de chaque colonie et établi la corrélation entre le rendement et le degré d'infection pour chaque date d'échantillonnage.

Spécialiste en apiculture, Ferme expérimentale centrale, Ottawa; autrefois de la Ferme expérimentale de Brandon (Man.).

1—Tubes centrifugeurs contenant des broyages d'abdomen d'abeilles. Couche blanche: milliards de spores de la nosémose.

2—A gauche, intestin apparemment sain. Adroite, intestin blanc et enflé, infecté de nosémose.

TABLEAU 1

MOYENNE D'INFECTION (en millions de spores par abeille) DANS DES COLONIES INOCULÉES DE NOSÉMOSE ET RENDEMENT MOYEN EN MIEL.

Date d'échantillonnage	Degré d'infection				
	0	40,000	200,000	1,000,000	corrélation
mai 12.....	.90	2.70	5.87	6.94	−.21
mai 22.....	.67	6.60	9.05	16.17	−.46**
juin 2.....	.94	2.40	5.45	11.24	−.57**
juin 15.....	.92	.67	2.15	3.74	−.44**
juin 26.....	.39	.35	.39	1.10	−.36*
août 3.....	.02	.26	.21	.71	
Rendement moyen.....	34.5 kg	32.1 kg	31.3 kg	24.1 kg	
Éventail (kg)..	20–48	2–53	3–51	0–45	

[1] KG = 2.2 livres
* A 5% de probabilité
** A 1% de probabilité

1

2

RÉSULTATS ET DISCUSSION

Le niveau moyen d'infection dans chaque cas avait atteint sa pointe le 22 mai (tableau 1). Dans quelques colonies l'infection était devenue rapidement sérieuse tandis que dans d'autres elle avait été moins sévère; dans le dernier cas les abeilles ont récupéré plus tôt. On peut attribuer ces variations au caractère génétique de chaque colonie. Nous avions déjà remarqué (1963) que quelques colonies étaient plus ou moins résistantes à la nosémose. Récemment (1965) nous avons démontré que certaines reines manifestent différents degrés de résistance ou de susceptibilité à la nosémose.

Une légère mais persistante infection fut enregistrée dans un certain nombre de colonies du groupe témoin. Des abeilles pillardes ou égarées provenant des colonies contaminées étaient peut-être la cause de cette infection. Vers la fin de l'été, la plupart des colonies ont surmonté l'infection à l'exception de deux colonies contrôle, deux colonies du groupe sous le traitement de 40,000, une colonie du groupe de 200,000 et quatre colonies du groupe de 1,000,000. Le rendement a considérablement varié entre les colonies de chaque groupe (voir éventail tableau 1). Les colonies ayant reçu la plus forte quantité de spores ont aussi subi des supercédures de reines.

Afin d'évaluer l'importance des effets de la nosémose sur le rendement, nous avons à chaque date d'échantillonnage établi le rapport entre le rendement et le degré d'infection. La corrélation a été hautement négative pour l'échantillonage prélevé vers la fin de mai et au début de juin (tableau 1). Ceci signifie qu'une infection élevée dans la colonie vers la fin de mai réduira le rendement en miel.

CONCLUSION:

Les résultats obtenus dans cette étude indiquent que la nosémose joue un rôle important dans le rendement des colonies. Nous conseillons donc aux apiculteurs d'échantillonner leurs colonies en mai afin de déterminer le degré d'infection et pouvoir ainsi estimer le rendement. Si les colonies sont sérieusement nosémateuses l'apiculteur ne peut s'attendre à un rendement optimum à moins qu'il emploie la drogue fumagilline pour enrayer la maladie.

Pour plus de reseignements on peut s'adresser à l'auteur, Institut de la recherche entomologique, Ferme expérimentale centrale, Ministère de l'Agriculture du Canada, Ottawa.

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Crop emergence on poorly managed solonetzic soils.

Crop emergence on well managed solonetzic soils.

increased grain yields on

R. R. CAIRNS

Cereal crop yields can be substantially increased on Solonetz soil. At the Soil Research Sub-station, Vegreville, Alta., we have found that surface drainage, seed-bed preparation, seeding, fertilization and tillage are key controllable factors in crop production. The first three factors are relatively simple. The accumulation of surface water on these high salt soils is disastrous and must be prevented if at all possible. Seed-bed preparation and seeding must be done in such a manner as to allow good seed-to-moist-soil contact. The fertility and tillage factors are more complex and may prove to be more variable.

In our investigations at Vegreville we conducted two experiments to study tillage, amendment and fertility effects on crop production. One study, carried out on what is normally considered to be very unproductive Solonetz soil, was designed to compare the use of the plow vs. no plow in combination with various subsequent tillage operations. We conducted this study through six crops in a fallow-wheat rotation, fertilizing each crop with 50 lb. of 11-48-0 per acre. However, by 1962, we found that these soils were not capable of releasing appreciable quantities of nitrogen. As a result, we decided to split the plots, and on half of each, applied a supplemental dressing of 33.5-0-0 at 300 lb. per acre. This was done in the fall of 1962 and again in 1963 for the 1963 and 1964 crops.

Through six crops, wheat on land that had been plowed to a 4-inch depth, yielded an average of 35.8 bushels per acre as compared with an average yield of 33.2 bushels per acre where no plowing had been done. In 1963, following very wet conditions of 1962, the crop yield was depressed by plowing. In the other five crop years, the plowed crop was as good or better than that on unplowed land. The effect of the supplemental fertilization with nitrogen was measured in only two crop years. Conditions for crop response were very good in 1963 and this treatment increased the yield nearly 15 bushels per acre where only the nitrogen was applied. However crop response was restricted in 1964 because of drought and the supplementary treatment increased the yield only 1.2 bushels. The use of various deep tillage procedures during the fallow year had no significant effect on crop yields. These operations substantially increase cost and there is at present no basis for recommending them.

Our second experiment was carried out on fairly unproductive solonetzic soil within three, 3-year rotations of fallow-wheat-barley. Various tillage, fertility and amendment treatments were applied in the fallow years of the three rotations. The treatments applied

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Soil crusting and crop damage caused by the accumulation of surface water on solonetzic soil.

solonetz soil

were. Check (disc implements only); heavy duty cultivator with chisel points at 10-inch depth with and without the addition of 5 tons of gypsum per acre; chisel 22 inches deep at 18-inch spacing with and without the placement of 250 pounds of vermiculite or 1600 pounds of 11-48-0 per acre through the chisel.

We found that the various tillage and amendment (gypsum and vermiculite) treatments had no significant effects on yields. Fertilizer significantly increased grain crop yields from an average of about 35 bushels per acre wheat equivalent (pounds of crop per acre divided by 60) for all other treatments to about 47 bushels per acre. The rate of fertilizer application was obviously uneconomic and probably unnecessarily high. The results do, however, show that very substantial productivity can be achieved through fertilization. During these trials, we observed that the fertilizer treatment improved the tilth of the soil. This improvement appears to have been related to the increased productivity resulting from fertilization.

Yield increases provided by fertilization are well worth striving to achieve. It would seem that much lower quantities of fertilizer than those used should provide the increased yield, but getting results may well depend on proper fertilizer placement and possibly formulation. Our future work will be directed towards the goal of economically procuring a high level of cereal production through fertilization. •

Solonetzic soils cover many million acres in Western Canada. Almost 10 million acres occur in Alberta and the remainder in Saskatchewan and Manitoba. They occur mainly in the Black, Dark Brown and Brown Soil Zones. That they present serious production problems because of their physical characteristics has been known for some time, but it has now been established that a serious nutritional problem is also involved.

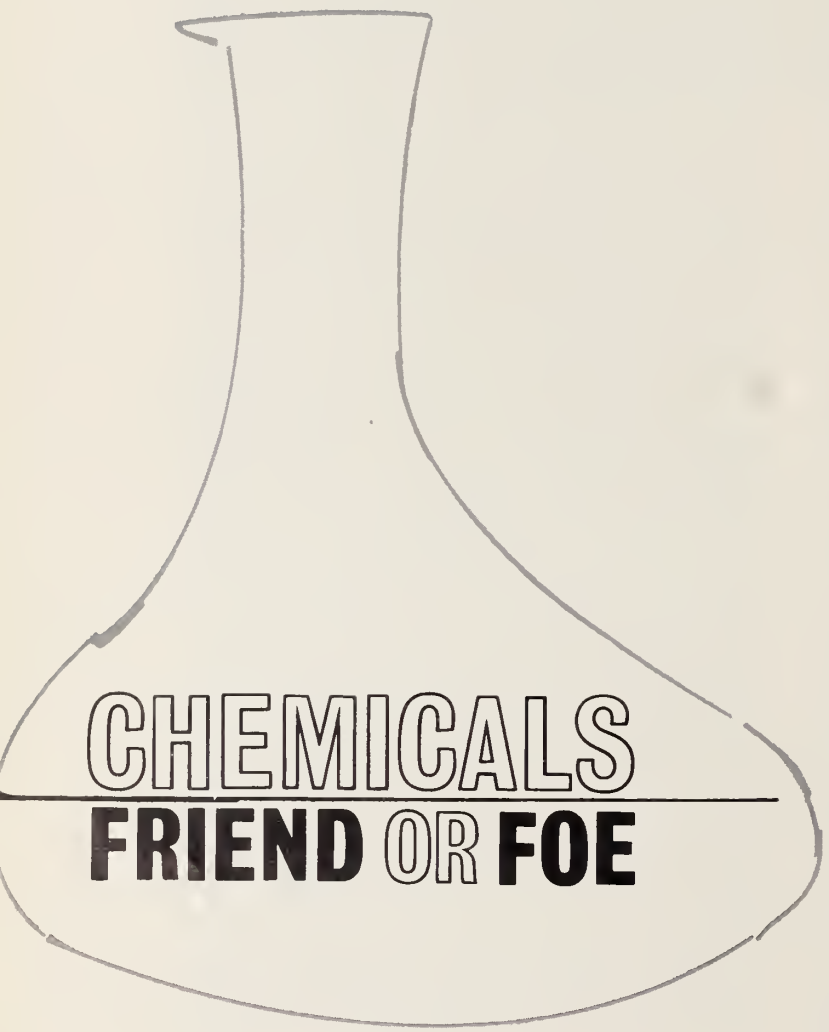
Solonetzic soils may be recognized by the great variability in crop growth that causes a patchiness in the appearance of the crop. Areas under fallow may be very misleading to the inexperienced, for the dry soil may be black and powdery and look as if it ought to be fertile. It is only after heavy rain or irrigation when water is held on the soil surface because of their impermeable nature, that these soils betray how intractable they are. In some areas however the surface is covered with shallow depressions, known as slick spots or burnouts. It is only by digging that they may be clearly recognized and the seriousness of their condition assessed.

There are three main Solonetzic conditions, termed Solonetz, Solodized-Solonetz, and Solod. They often occur in association with even less productive Saline soil and the more productive normal soil. The least productive member is the Solonetz and the most productive, the Solod with the other falling between. Identification is based on the condition of the B horizon. Soils, during their development, become layered. The surface layer (A horizon) of reasonably mellow soil may vary in depth from a few inches to over a foot. A whitish layer may or may not occur immediately beneath it although such a layer usually occurs in the more productive soils. However, the massive B horizon, in which clay has accumulated, is the one by which Solonetzic soils are identified. It can be easily recognized because of the great difficulty in digging through it. It will be encountered within six inches of the surface on the less productive soils and at a depth of a foot or so in the more productive ones. In all cases this horizon of a Solonetzic soil breaks into vertical columns, whereas that of a normal soil breaks into crumbs. If the columns are massive and flat-topped and occur within a few inches of the surface, the soil is Solonetz. If the columns occur a little deeper or have distinctly rounded tops, the soil is Solodized-Solonetz. If the columns occur at considerable depth and are fairly mellow, the soil is a Solod. The Solod does not present nearly as serious a production problem as the other members.

All Solonetzic soils have been influenced by sodium or magnesium salts during their development. The influence of these salts determines the nature of the B horizon and it, in turn, creates the poor physical property because of its impermeability to water and resistance to root penetration. During the early stages of the development of Solonetzic soils a massive B horizon is formed which, on further development, tends to disintegrate at the top giving rounded columns. In later development the clay columns further disintegrate and move deeper in the profile.

With this limited outline of the features and method of development of Solonetzic soils, it is easy to understand that their physical characteristics limit productivity.

—RESEARCH FOR FARMERS
SUMMER, 1961
(R. R. CAIRNS)



C. H. JEFFERSON

Perhaps no one is more aware of the incessant struggle for survival among living things, than the farmer. He knows what happens to neglected livestock, or to an unattended field. The stock die and the field becomes overgrown with weeds, ultimately to be replaced by bush, the climax vegetation of the region and populated by a few rabbits and other wildlife. In the case of the dead animal, it can be turned to little use to fill human needs, while the field 'gone back to nature' produces little that will sustain human life.

MAN AND NATURE

The so-called natural state of that field, and similarly of the whole world, unmanipulated by the hand and mind of man, while containing tremendous resources, is largely unproductive in food and fibre suited to man's survival. Man, being a part of nature, is also under continual direct pressure, attack or predation by other living things, limited mostly to bacteria, fungi, viruses and insects, if not his fellow man! Fortunately, most of these predators on man also have enemies that, in effect, come to our defence. Most of us also have been given a legacy of ability to develop within our own bodies resistances to such predators and, if this were not so, I am sure we would have long ago gone the way of the Dodo.

What has this got to do with chemicals you may wonder? To explain, all matter is made up of chemicals and so are we. As a matter of fact, the 'stuff' of living things is composed of perhaps an infinite variety of chemicals; and living organisms, such as you and I, manufacture them to sustain life. These chemicals, composed principally of the elements oxygen, carbon and hydrogen, but also containing other elements such as nitrogen, phosphorus, potassium, chlorine and selenium, include some of the most complex in structure. In addition, they have tremendous potency, far more so than that of most pesticides in use today. The same situation exists in plants. Each new variety or strain of crop plant, and this applies to those that are disease or pest resistant, has a different chemical make-up than other and older varieties.

Little is known about most of these naturally occurring chemicals; in fact, it is probably true that most have yet to be identified, studied and their properties

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determined. It may be surprising to learn that the most wholesome and necessary foods contain naturally occurring chemicals in minute quantities which, in larger amounts, are highly toxic and when taken alone or 'out of context' would be damaging to health, if not lethal.

FRIEND OR FOE?

Chemicals, friend or foe? This is a question that baffles the best brains, yet one that must be answered daily by those engaged in crop production. Now the word 'chemicals' used in reference to agricultural production does not necessarily pertain to the chemical components of plants and animals; however, in the context of 'friend' or 'foe', it is useful to recall that all matter is composed of chemicals. Friend or foe, non-toxic or toxic, harmless or harmful, what do these antonyms mean? They do have something in common —namely, that their application and true meaning depend entirely on the circumstances in which they are applied. One's foe may become a friend under other circumstances and vice versa. A chemical, harmful under one set of circumstances, will be beneficial under another set.

The characteristics of cause and effect are different for each chemical and set of circumstances. Hence, the use of strychnine may, in one case, save a life and, in another, bring death. Animals cannot live without selenium, yet it is one of the most toxic of metals in larger than safe amounts.

There is a saying in medicine to the effect that any chemical in sufficient concentration will kill protoplasm (destroy life), and at a somewhat lower concentration, will stimulate; and even with further dilution will have no effect. In other words, "a chemical (or any material) has no effect, is useful, or is harmful, depending upon the dose."

The nature of things is such that it is not possible to prove positively, for example, that a pesticide residue, a particular food or anything, has no harmful effect. Studies could go on for years and a harmful effect not be detected, yet there is always the possibility that if the search were to continue, an effect would be detected. As much as we would like to attain absolute goodness, or safety, such does not seem the nature of things—there is good in the worst and bad in the best.

Let's consider, briefly, the main agricultural 'chemicals' in Canada—fertilizers. At the present time, most people will concede that fertilizers are 'friends', at least as far as crop production is concerned. Canada uses far less plant food per unit of production than do most other countries with advanced agricultural production. The Canadian trend is still strongly in the direction of higher rates of usage. We feel relatively safe using fertilizers because, after all, they are simply supplying some of the nutrient elements already found in soil and plants, and what harm could *more* of these possibly do?

Fertilizer applications that raise the soil content above the optimum for good root uptake and growth do depress yields. As the use of fertilizer increases, so likely will the opportunity for harmful effects. Not enough of one element and an over-abundance of another can have disastrous effects in terms of crop yield and quality. The lesser plant nutrients, where the margin between the 'stimulating' and the 'toxic' application rates is narrow, will likely become a greater problem as soil reserves of them are increasingly recognized as inadequate for maximum crop production. Growers will have to be alert to the dangers of over-application which could turn a fertilizer 'friend' into a 'foe'. Those who are producing a crop for processing, which must meet fairly specific quality requirements, will have to take special care in this respect. In addition to yield effects, fertilization can affect quality factors as well. The effect of excess chlorine on potatoes and tobacco is widely known. Apart from the possibility of nitrogen use raising nitrate levels in plants to toxic proportions, there does not seem, at present at least, to be a toxicity hazard for humans or animals from the use of fertilizer.

Pesticides (the other major group of farm chemicals) are, at the present time, receiving more attention as possible 'foes' than any other group of chemicals. Since World War II, and sparked by the phenomenal success of DDT, the western world has mounted a markedly successful program of synthesizing organic chemicals and testing them for possible use in controlling the innumerable pests that plague man and consume,

Early morning orchard spraying for more and healthier apples at harvest.

Pesticide Testing Laboratory, Ottawa.

Pesticide residue analysis, thin layer chromatography.

spoil or prevent the production of domestic animals and cultivated crops. So successful have many of these new pesticides been that they have found a ready market and broad application in agricultural production. The development of monocultural practices, where a single crop is grown in large acreage, or where large herds or flocks are assembled, has made the possibility of a pest attack more likely and certainly much more disastrous when it does occur, unless controlled.

As a matter of fact, many of the most productive crops such as the cereals, corn, vegetables of all sorts, tobacco and soybeans, cannot be produced at all without some form of pest control. The mass production techniques that have made our agriculture so spectacularly efficient and productive, require a high level of efficiency in pest control.

The breeding of resistant varieties, crop rotations and other management techniques provide some measure of control, but without supplemental help from pesticides, losses would be severe and many crops would not be produced commercially.

I often wonder just how we would manage to produce apples, peaches, potatoes, turnips, corn, any of the cole crops, cabbage cauliflower and the like—without the use of pesticides. The urban dweller—yes, and even those who live in the country but do not farm—may not fully realize their reliance on pest control. If one stops to think about it, he can quickly recall some personal experience to illustrate his own reliance on pesticides.

When one has the 'flu', infectious hepatitus or other ailment due to an infection, and takes medication for it, he is, in fact, taking a pesticide although it is called a medicine or drug. One's cat or dog becomes infested with worms and is consequently given a dose of wormer—a pesticide. The canary gets fleas but can be rid of them by the use of a flea killer—a pesticide. Crabgrass in the lawn, plant lice on the African violet, carpet beetles in the rug and winter clothing, flies, mosquitoes and wasps, these are nuisances that modern man no longer needs to tolerate when he can control them with a chemical—a pesticide. We have come to rely on pesticides, not only for survival but also for comfort. Quite apart from their indispensible role in providing direct protection to man, particularly in tropical countries where malaria, typhoid fever and other diseases are held in check through their use, pesticides account for a very significant part of our food supply. Estimates on this vary, but should all pesticide use cease today, the effect on our economy and that of the United States would constitute a catastrophic continental disaster. We would, within a year, join the less developed nations in that our capacity to produce and store many foods would fall far short of our present needs.

ALTERNATIVES

Some alternate measures for pest control could be brought to bear but these would call for high labor input and diversification of production. Biological control, the breeding of pest-resistant varieties, and stringent sanitary measures could *perhaps* ultimately replace pesticides but these would be slow in producing results. Virtually all of our vegetables and fruits, both home-grown and imported, are produced with the aid of pesticides. Well over 50 per cent of cereal and grain production in Canada is also protected with pesticides.

Yes, I think when one considers what the cessation of pesticide use would bring in human suffering and loss of life, the only conclusion to be drawn is that pesticides are friends—and not foes!

Let's not be complacent, however, for to abuse a friend is to create a foe. Pesticides are by nature and design a very powerful force. The pesticides used each year in Canada probably have the power of '500,000 men'. Consider the army that would be required to pull the weeds on 25 to 30 million acres of western grain fields or to brush out the tens of thousands of road and hydro rights-of-way. The abuse of pesticides, either wilfully or through ignorance of just what constitutes abuse, in effect, turns some of this 'man-power' against us. Thus far, however, no more than the occasional turncoat has occurred. Perhaps, though, some have become 'undercover' agents and their activity has not yet been fully realized. It is this possibility, I feel, that so inspired Miss Carson to write Silent Spring!

HAZARDS

The misuse of fire and abuse of the automobile have been costly. Losses in Canada last year due to fire included 657 fatalities, while traffic accidents in 1964 caused 4,750 deaths. Other abuses not given as wide publicity had the following dramatic effects:

FATALITIES DUE TO ACCIDENTS IN 1964

Drownings	1,072
Poisonings Total all causes	421
Classified into these causes:	
(a) drugs and solvents	193
(b) gas and vapors	170
(c) alcohol	58
(d) pesticides	2
Suffocation due to food	382

I mention these statistics simply to illustrate the price we pay, and are prepared to pay, as a country, for the benefits we derive from the various causes of these accidental deaths.

With pesticides, which are generally represented and recognized to be basically harmful, if not highly poisonous, we have thus far had a much better experience, with but a few incidents of serious poisoning and only one or two accidental fatalities annually. These cases arose from gross misuse and none have been the result of pesticide residues on food.

PCP ACT

The Parliament of Canada passed a law in 1939 called the Pest Control Products Act (PCP Act). Basically, this law requires that all pesticides sold in Canada to the general public have to be registered and meet specific label requirements before being put on the market for sale. To be registered, a pesticide has to be proven effective and safe for the declared or intended purpose, when used according to the directions and cautions on the label. This law is administered and enforced by the Plant Products Division, Canada Department of Agriculture. Although some 3,500 different pesticides were registered for use in 1965, this number could be exceeded in 1966. All of these products are examined and samples analysed to verify their composition in relation to the registration record and the label declaration of active ingredient content. Inspectors are continually examining stocks of these pesticides wherever they find them—in the

R. B. Maybury, Supervisor of the Pesticide Unit of the C.D.A. Plant Products Division Analytical Control Lab., performs pesticide analysis on infra-red spectrophotometer in Ottawa Laboratory.

Plant Products Building, Ottawa.

manufacturers' plant, at wholesale and retail stores and even on the farm.

Manufacturers take great pains to learn as much about their pesticides as seems necessary, to assure usefulness and safety in use, and this is reflected in the label claims, cautions and directions for use for their products. Their findings and those of others are examined under the terms of the PCP Act to assure that the available evidence supports the label representations.

As I pointed out earlier, most pesticides can be expected to be very powerful, if not downright toxic, and harmful when used in a manner other than recommended. Labels for the more potentially dangerous products give specific warning of the possible consequences of misuse.

It is when these warnings, and the directions on the label, are not followed that one is abusing 'a friend' to the point that it may well become a deadly 'foe'.

REGULATION—MORE OR LESS?

Many people with interests other than in the *benefits* of pesticides seem to be pressing hard to force the withdrawal of these chemicals. The adverse consequences of misuse provide a solid basis for their representations. Should the incidence of such misuse become high, there is no doubt that the particular pesticide in question will likely be withdrawn from use. The book, 'Silent Spring', referred to earlier, gave great credence to innuendo, and implied that 'possible' effects of pesticides were, in fact, causing general harm to the living world around us, if not to man himself. Continuing studies of cause and effect relationships since that time are gradually revealing additional facts with which to more accurately interpret the changes that are continually in process in wildlife populations. These data will make it less easy to assume that all declines in wildlife are due to pesticides—after all, the dinosaur actually became extinct without the aid of pesticides! In some areas of heavy and long pesticide use in the United States, wildlife of all kinds have increased significantly—*perhaps* because of pesticides!

There are, of course, intermediate steps that can be taken to reduce the hazards from pesticides which are less drastic than complete cessation of use. For example, the availability of hazard-prone pesticides can be restricted under legislation that calls for the licensing of vendors, requires the user to obtain a permit, or even limits use to government supervised applications. Such measures, while helping to assure that pesticides are more 'friend' than 'foe' will increase cost, and reduce availability and use, making it more expensive to produce those crops dependent upon pesticide use. The cost to the general public will ultimately be felt in higher prices for food. Legislation of this type, designed to control pesticide use, is in force in Ontario and Manitoba, and it is no doubt reducing the misuse of many pesticides. As the use of pesticides becomes more general, more intensive and more frequent in the struggle to bend 'nature' to man's own ends, their impact becomes correspondingly greater. Misuse by the same token has greater implications for all. Where a little is good, 'more' may *not* be so good. What works for one pest problem may not work for another. What does not produce a residue in one situation may well do so in another. Pesticides, therefore, should only be used as recommended.

PESTICIDE LABELS

You are, I am sure, familiar with the pesticide label. It tends to be crowded with small print and a great deal of important information on 'uses' and 'how to apply'. Also, there is additional vital information that may be in small print setting out the warnings and cautions.

It has become increasingly important for pesticide users to read and follow the information on the pesticide label. All have a moral and a legal responsibility to use pesticides properly. If farmers are unable to do so on their own initiative, then that initiative will pass to some control agency to decide the 'what, when, and how' of pesticide use. Pesticides are extremely vulnerable to such regulation in the public interest. It is easy to arouse public emotions for the repression of a hazardous commodity when the benefits of that commodity are not clearly evident. Responsible and careful attention to the proper use of pesticides by farmers is essential, in reducing the pressures for more control. In addition, more emphasis could be given to the 'plus' factors of freely available pesticides.

WHAT OF THE FUTURE?

The impact of a disproportionate concern for the hazard aspects of pesticides seems to be causing a trend away from research on new pesticides and the best way to use the ones already available. Tight regulations on distribution and use will further discourage the use of chemicals for pest control. While every caution should be exercised to keep the *harmful* consequences of pesticide use to a minimum, it may be that to achieve their greatest net advantage, we will have to accept *some harm* as a part of the price of retaining such a valued and effective ally in our struggle to wrest the 'good life' for an every expanding population.

Pesticides *are* a substantial friend as are other agricultural chemicals. We all have a job to do to keep it that way. •

PUBLICATIONS

Copies of these, and a list of other publications may be obtained free of charge (unless otherwise stated) from: Information Division, Canada Department of Agriculture, Ottawa.

On peut obtenir gratuitement (à moins d'avis contraire) des exemplaires de ces publications ainsi qu'une liste d'autres publications à: la Division de l'information, ministère de l'Agriculture du Canada, Ottawa.

627 CARE OF FARM DAIRY EQUIPMENT 12 pp. Proper care of equipment means fewer breakdowns and ensures clean, wholesome milk.

627 ENTRETIEN DES USTENSILES LAITIERS SUR LA FERME 12 pp. Les soins convenables permettent d'assurer un lait sain et d'éviter des réparations coûteuses.

1236 FEEDLOT FINISHING OF CATTLE AND LAMBS IN WESTERN CANADA 32 pp. Combine good facilities, quality stock and good food and water for a profitable operation.

1236 ENGRAISSEMENT EN PARQUETS DES BOVINS ET DES AGNEAUX, DANS L'OUEST CANADIEN 32 pp. Installations, bétail, aliments: financement et considérations pratiques.

1294 BARBECUE COOKING 12pp. Recipes and hints for the outdoor chef.

1294 LA CUISINE BARBECUE 12 pp. Recettes et suggestions pour la cuisine en plein air.

880 DISEASES AND INSECT PESTS OF RASPBERRIES AND OTHER CANE FRUITS 33 pp. Good quality fruit depends upon careful observation and immediate treatment of all abnormalities.

880 MALADIES ET INSECTES DES FRAMBOISIERS ET AUTRES RONCES 32 pp. Le traitement immédiat de toute anomalie est essentiel à la production de fruits de haute qualité.

892 FREEZING FOODS 24 pp. Vegetables, meat and fish can be preserved for months without loss of flavor or nutritive value.

892 LA CONGÉLATION DES ALIMENTS 24 pp. Les légumes, la viande et la volaille peuvent être gardés des mois, et cela sans perte de saveur ni de valeur nutritive.

1212 CONTROL OF WASPS AND BEES 4 pp. Chemical and mechanical methods of self-protection from summertime pests.

1212 RÉPRESSION DES GUÊPES ET DES ABEILLES 4 pp. Moyens chimiques et mécaniques de répression.

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